CHAPTER 3

AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

This chapter describes the existing resources in the project area and characterizes their current conditions as a baseline for further environmental analysis. Potential environmental effects of the alternatives are then disclosed so that an informed decision may be made by the NRCS (the lead agency and decision-maker) regarding the Coal Creek project. This chapter includes the following sections.

- General Description
- Impacts Assessment
- Affected Environment, Environmental Consequences of Alternatives, and Mitigation, by Resource
- Cumulative Impacts
- Unavoidable Adverse Effects
- Irretrievable and Irreversible Commitments of Resources
- Relationship of Short-term Uses and Long-term Productivity

3.1 GENERAL DESCRIPTION

The Coal Creek project area is located in Cedar City, in Iron County, Utah. The region is renowned for the many National Parks and Monuments that showcase varied red-rock landscapes and is a destination for recreationists worldwide. Cedar City, the most populous community in the county, is situated on ancient alluvium at the mouth of Cedar Canyon. Coal Creek exits from Cedar Canyon and runs west through the community. There are several diversion/drop structures along the channel that divert water to the south and northwest for irrigation use. The creek typically carries a high sediment load, which has caused deposition around the Main Street Bridge and other locations, leading to backwater effects and channel capacity deficiencies.

The alternatives presented in Chapter 2 are analyzed in the following sections with respect to their potential effects on air quality, geology and soils, surface water and groundwater, vegetation, wetland and riparian resources, wildlife, special status species, cultural resources, recreation and visual resources, socioeconomics, and minority populations. The NED benefit-cost analysis required by NRCS for this project is also summarized. The alternatives and options analyzed in the following sections are conceptual in nature. While final engineering design may change the exact placement, orientation, or size of some of the structures, the overall impact footprint should remain relatively consistent and may even slightly overestimate potential impacts. This conservative approach was taken to ensure that all potential impacts would be disclosed.

3.2 Impact Assessment

The alternatives outlined in Chapter 2 may cause, directly or indirectly, changes in the human environment. This EIS assesses and analyzes these potential changes and discloses the effects to the decision-makers and public. This process of disclosure is the fundamental aim of NEPA.

There are many concepts and terms used in discussing impacts assessment that may not be familiar to the average reader. The following sections attempt to clarify some of these concepts.

3.2.1 Impacts/Effects

The terms *effect* and *impact* are synonymous under NEPA. Effects may be ecological, aesthetic, historical, cultural, economic, social, or health-related phenomena and may be direct, indirect, or cumulative in nature.

3.2.2 Significance

The word *significant* has a very particular meaning when used in a NEPA document.

Significance is defined by the CEQ as a measure of the *intensity* and the *context* of effects of a major federal action on, or the importance of that action to, the human environment. *Significance* is a function of the positive/beneficial and negative/adverse impacts of an action on the environment.

- Intensity refers to the severity or level of magnitude of impact. Factors such as public health and safety, proximity to sensitive areas, level of controversy, unique risks, or is potentially precedent-setting effects, are all things to be evaluated in determining intensity. This EIS will primarily use the terms Major, Moderate, and Minor, and Negligible in describing the intensity of impacts.
- Context means that the effect(s) of an action must be analyzed within a framework or within physical or conceptual limits. Resource disciplines, location of area affected, type of area affected, size of area affected (e.g., local, regional, national), and affected interests are all elements of context that ultimately determine significance. Essentially, context (and thus significance) varies with the setting of the alternative being discussed. Both long- and short-term effects are relevant.

Use of the term *significant* when referring to effects indicates the exceedance of some significance threshold for a particular impact indicator. Impact indicators are the consistent currency used to determine change (and the intensity of change) in a resource. For example, an indicator of water quality might be the total suspended solids present in a given volume of water. Working from an established "existing condition" (i.e., baseline condition), this indicator would be a focus of study in assessing overall water quality and would be measured, not only in comparison to existing conditions, but in comparison to the other alternatives. The indicator remains a focal point throughout the description of the affected environment and the analysis of impacts, whether impacts are negligible, adverse, or beneficial.

3.2.3 Direct Effects

A *direct effect* caused by an alternative occurs at the same time and place.

3.2.4 Indirect Effects

Indirect effects are reasonably foreseeable effects that are caused by the proposed action, but are later in time or farther removed in distance. Direct and indirect effects will be combined in the environmental consequences section of this chapter.

3.2.5 Cumulative Effects

Cumulative effects result from the incremental effect of an action when added to other past, present and reasonably foreseeable future actions. Cumulative impacts can result from individually minor, but collectively significant actions taking place over a period of time.

3.2.6 Environmental Effect Categories

The following effect categories attempt to capture relative levels of effect intensity and context for each resource analyzed in subsequent sections (Table 3.1).

3.3 Air Quality

Air quality within the project area and its surrounding airshed has the potential to be affected by pollutant-generating activities detailed in this EIS. This section describes the physical and climatological factors that influence air quality, the existing air quality resource of the project area, the applicable air regulations that would apply to the alternatives, and the impacts to air quality that would result from implementation of the alternatives detailed in this EIS.

Table 3.1. Summary of Attributes Used to Describe Effects in the Coal Creek EIS

Attribute of Effect		Description
Quality	Beneficial	An improvement of current conditions.
	Negligible	No change in current conditions.
	Adverse	A degradation of current conditions.
Magnitude (Intensity)	Major	A big change in current conditions.
	Moderate	A moderate change in current conditions.
	Minor	A small change in current conditions.
Duration (Intensity)	Transient/Temporary	Very short-lived (e.g., during construction).
	Short-term	5 years or less.
	Long-term	More than 5 years.

3.3.1 Existing Conditions

The project area is located in/near Cedar City, Utah, in Iron County, in the southwestern corner of the state. Elevations within the project area range between 5,490 feet near the mouth of Cedar Canyon to 5,172 feet at the western extent of the project area near Quichapa Lake (west of the I-15 corridor). The climate in this region of the state varies widely with altitude (World Climate 2005).

3.3.1.1 Climate and Weather

The climate in the project area can be characterized as arid, with cold winters and hot summers. Annual precipitation (rainfall and snowfall) in the project area ranges from 5 to 22 inches, depending largely on elevation and aspect, with the eastern section of the project area (near 500 East and the mouth of the canyon) showing slightly higher seasonal and annual totals than the western section (near the airport). Precipitation averages between 10 and 15 inches annually. Climate varies throughout the project area with elevation. In the higher elevations above the project area, precipitation comes in the form of snow, with deep accumulations in the late fall and winter. Snowmelt in the higher elevations is generally complete by mid to late June. Afternoon thunderstorms often result in flash flooding and are common from late spring through early fall. The project area experiences wide temperature variations between seasons. Summer high temperatures in the project area often reach 100°F, with lows in the 70s. Winters are cold, with highs averaging approximately 25°F, and average lows ranging from 0°F to 20°F (WRCC 2005).

The western section of the project area receives an average of 10.5 inches of precipitation a year. Much of this moisture comes in the form of melting winter snows. Dry air, high elevations (5,500–6,000 feet), and winter snowfall combine to create a cold, high desert. However, most precipitation falls in late summer and early autumn thunderstorms.

Maximum summer temperatures range from 90°F to 105°F. Winters are cold and relatively dry, with highs around 25°F and lows in the low to mid teens. Extreme winter temperatures can reach –26°F (WRCC 2005).

The eastern section of the project area receives an average of 15.2 inches of precipitation a year, most of which comes in the form of late spring rains and fall and winter snows. Maximum summer temperatures range from 85°F to 100°F. Winter high temperatures average 26°F, and lows average 19°F. Extreme winter temperatures can reach –25°F (WRCC 2005).

Summer precipitation is often in the form of short, intense, and highly localized thunderstorms, while winter precipitation results in accumulated snow pack that infiltrates the soil and recharges the aquifers. Snowfall in the Cedar City area averages 45.4 inches per year. High elevation snow pack averages 90–100 inches in a normal water year (WRCC 2005).

Air temperature and precipitation data collected from 1948 through 2004 for two locations in the project area are displayed in Table 3.2 and Figure 3.1 (WRCC 2005). Peak elevation temperature and precipitation information was not available.

Table 3.2. Temperature and Precipitation Data Available for Monitored Locations in or near the Coal Creek Project Area (WRCC 2005)

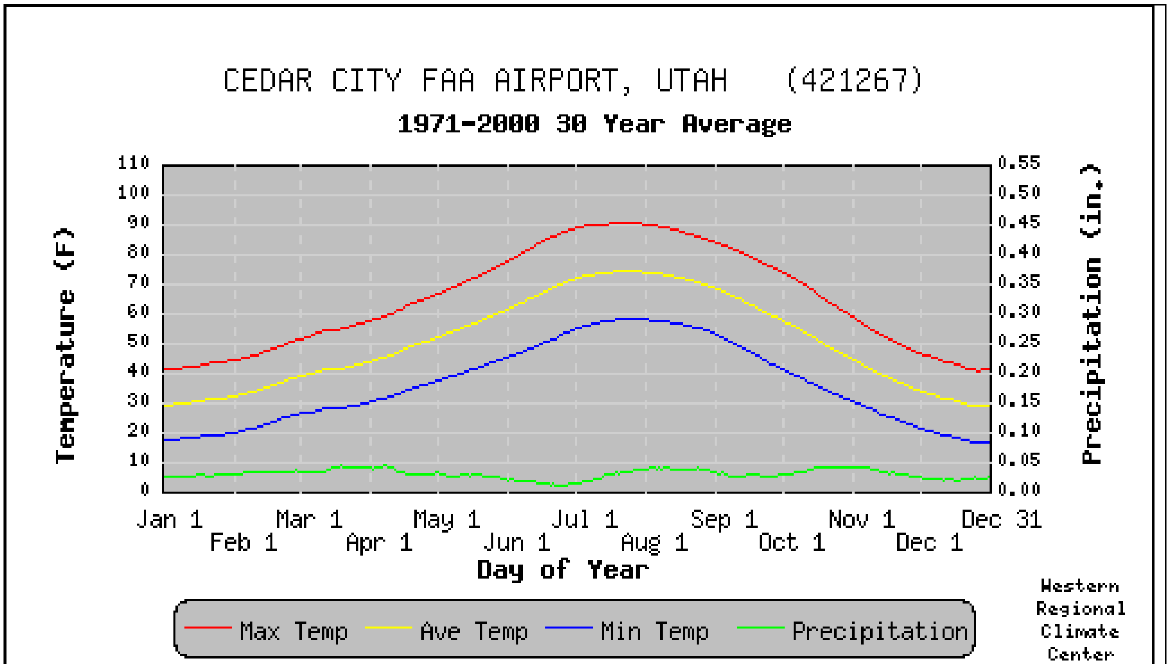
		TEMPERATURE (°F)					
		Summer Mean		Winter Mean		Extremes	
Station	Period of Record	High	Low	High	Low	High	Low
Cedar City Airport	1948-2004	90.1	79.8	25.2	17.4	105	-26
500 East	1983-2004	85.2	76.1	26.4	19.1	100	-25

		PRECIPITATION (INCHES)						
		Mean				Annual		
Station	Period of Record	Winter	Spring	Summer	Fall	Mean	High	Low
Cedar City Airport	1948-2004	2.3	2.9	2.6	2.7	10.5	16.9	5.2
500 East	1983-2004	3.4	4.4	3.6	3.7	15.2	22.1	11.9

3.3.1.2 Physical Factors Influencing Air Quality

Air quality in a localized area depends on dispersion, which is influenced by relative air temperature; the timing, strength, duration, and frequency of temperature inversions; and wind speed and direction relative to a pollutant source.

The project area and surrounding basin have been experiencing drought for much of the last five years. Drought conditions were manifest during the summer of 2002, when the Palmer Drought Severity Index (PDSI) reached near-record severity based on the last 100 years of



Max. Temp. is the average of all daily maximum temperatures recorded for the day of the year between the years 1971 and 2000.
Ave. Temp. is the average of all daily average temperatures recorded for the day of the year between the years 1971 and 2000.
Min. Temp. is the average of all daily minimum temperatures recorded for the day of the year between the years 1971 and 2000.
Precipitation is the average of all daily total precipitation recorded for the day of the year between the years 1971 and 2000.

Figure 3.1. Thirty-year temperature and precipitation plots for the Cedar City, Utah airport climate station (WRCC 2005).

instrumental data (NCDC 2005). The drought conditions have resulted in decreased soil moisture and an increase of wind-blown dust and associated particulates in the project area and surrounding basin. Soils in the project area have been characterized as having low to moderate wind-erodibility.

When the air temperature near the ground is lower than the air temperature above, a phenomenon called an "inversion" occurs. Inversions may occur in winter when snow accumulation on the ground combines with short daylight hours to impede the sun's ability to warm the lower atmosphere, and can act to hinder air pollutant dispersion. Inversions do not routinely occur in the project area.

Wind also plays a role in air pollutant dispersion and in the generation of fugitive dust. Pollutant path is determined by the wind direction, and the speed and distance of pollutant transport is determined by the wind speed. Wind directions in the project area are somewhat seasonal in nature and are influenced by the local terrain. Data collected at the Cedar City Airport between 1999 and 2004 show the predominant wind direction to be south-southwest, with an average wind speed of 5.3 miles per hour (mph), followed by south-southeast,

southeast, and south wind directions with an average wind speed of 3.0 mph. Collectively, these wind directions represent 38.4% of the annual observations. Calm conditions occurred approximately 13% of the time (RAWS 2005).

Seasonal variations in wind speed and direction are moderate, with only small deviations from the data presented above. Winter wind direction is generally south-southeast at 3–4 mph; spring wind direction is generally south-southwest at 3–5 mph; summer wind direction varies between southwest and southeast (near equal frequency) at 3–5 mph; and fall wind direction is generally south-southeast at 3–4 mph (RAWS 2005).

Figure 3.2 presents seasonal windroses for the Cedar City Airport. Windroses are graphical representations of wind magnitude, frequency, and direction for a given location. As can be seen from the seasonal windroses, the wind patterns in the area are generally similar. Therefore, dispersion and transport of pollutants are expected to be fairly uniform over the course the year.

3.3.1.3 Regulatory Setting

The EPA delegates the authority to manage air resources to the state when a State Implementation Plan (SIP) is approved and implemented. The Utah Department of Environmental Quality (UDEQ) currently has approved SIPs for air quality programs under its jurisdiction and has received delegated authority from EPA for all air quality issues in the State of Utah, excluding tribal reservation lands. The air quality in Utah is currently regulated by the UDEQ, Division of Air Quality (UDAQ). All stationary sources of air pollution are subject to the air quality regulations and standards under UDAQ's administration. Sources located within tribal lands are not regulated by any SIP-approved programs—they are subject only to the federal air quality programs under the authority of EPA Region 8. None of the project area is within tribal lands.

The National Ambient Air Quality Standards (NAAQS) have been established by the EPA in 40 CFR § 50. The NAAQS represent the maximum allowable atmospheric concentrations that may occur without jeopardizing public health and welfare and include a reasonable margin of safety to protect the more sensitive individuals in the population. The NAAQS generally may not be exceeded more than once per year, except the annual standards, which may never be exceeded. The purpose of primary NAAQS is to protect the welfare of the most sensitive people, such as elderly and asthmatic individuals, while the purpose of secondary NAAQS is to protect vegetation, soil, etc. An area that does not meet the NAAQS is designated as a nonattainment area on a pollutant-by-pollutant basis.

Air quality in a given location is defined by pollutant concentrations in the atmosphere and is generally expressed in units of parts per million (ppm) or micrograms per cubic meter ($\mu g/m^3$). One measure of a pollutant is its concentration in comparison to a national and/or state ambient air quality standard. The State of Utah has adopted the NAAQS as state air quality standards as shown in Table 3.3. The Clean Air Act (CAA) amendments of the 1990s require all states to control air pollution emission sources so that NAAQS are met and maintained.

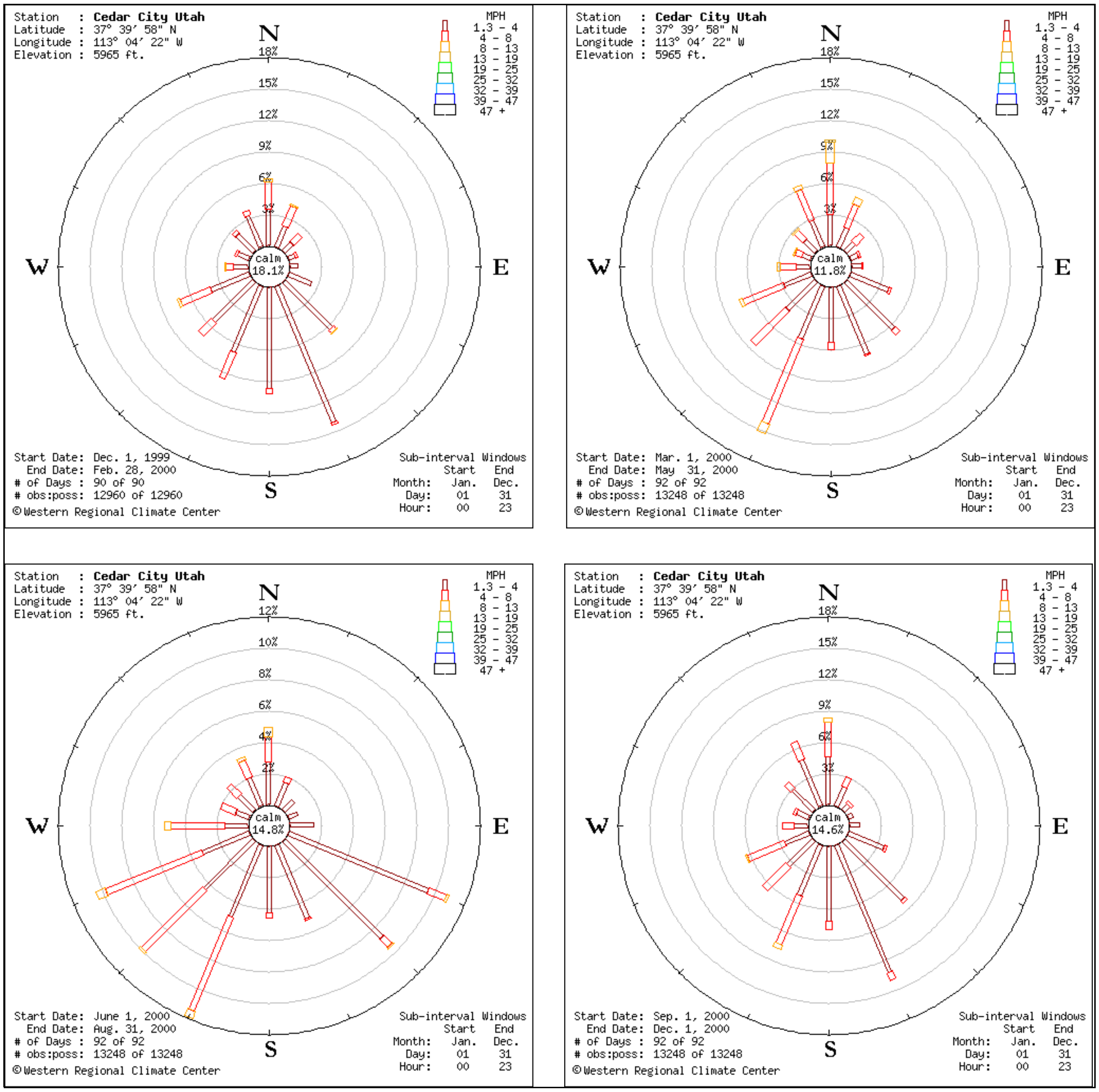


Figure 3.2. Seasonal windroses for 1999–2000 from observations taken at the Cedar City, Utah airport climate station (RAWS 2005).

Applicable air quality criteria also include the criteria for prevention of significant deterioration, known as PSD increments (EPA 2001). A PSD increment is the maximum increase in ambient concentrations of a certain pollutant that is allowed to occur above that pollutant's baseline concentration.

Areas designated PSD Class I are accorded the strictest protection to maintain pristine air quality; these areas include wilderness areas, national parks, and tribal reservation lands. Only very small incremental increases in concentration are allowed to maintain the very clean air quality in these areas. In Utah, five areas have been designated Class I areas; all are national parks under the administration of the National Park Service (NPS): Arches National Park, Bryce Canyon National Park, Canyonlands National Park, Capital Reef

National Park, and Zion National Park. PSD Class II areas are essentially all areas that are not designated Class I; moderate incremental increases in concentration are allowed, although the concentrations are not allowed to reach the NAAQS.

Table 3.3. National Ambient Air Quality Standards (NAAQS) for Criteria Pollutants

Pollutant	Averaging Period	NAAQS (µg/m)
CO	1-Hour [b]	40,000
	8-Hour [b]	10,000
PM_{10}	24-Hour [b]	150
	Annual [a]	50
$PM_{2.5}$	24-Hour [b]	65
	Annual [a]	15
SO_2	3-Hour [b]	1,300
	24-Hour [b]	365
	Annual [a]	80
NO_2	Annual [a]	100

[a] Annual arithmetic mean not to be exceeded.
[b] Not to be exceeded more than once per year.

No Class I areas are located within or adjacent to the project area. Zion National Park, at a distance of approximately 20 linear miles, and Bryce Canyon National Park, at a distance of approximately 50 linear miles, are the Class I areas located nearest the project area. Due to linear distances and dominant wind directions, pollutant transport and dispersion patterns within and adjacent to the project area will not likely transport pollutants into or near Zion or Bryce Canyon National Park (EPA 1999, 2001, 2003a, and 2003b).

3.3.1.4 Existing Air Quality

The Utah Air Quality Monitoring Center conducted monitoring for PM_{10} particulates in Cedar City from 1994 through 1997. The data collected were reported as annual mean of 24-hour average concentrations and second highest 24-hour average concentrations. The annual mean of 24-hour average concentration data showed concentrations of 22, 19, 18, and 18 $\mu g/m^3$ for 1994, 1995, 1996, and 1997, respectively. The air quality standard for annual mean of 24-hour average PM_{10} particulate concentration is 50 $\mu g/m^3$. All of the reported concentrations are less than 50% of the air quality standard and show no exceedance of the criteria (EPA 2005a, 2005b).

The second highest 24-hour average concentration data showed concentrations of 60, 34, 38, and 31 µg/m³ for 1994, 1995, 1996, and 1997, respectively. The air quality standard for 24-hour average concentration PM_{10} particulates is 150 µg/m³ (not to be exceeded more than once per year after compensating for days when monitoring did not occur). All of the reported concentrations in the project area are less than 50% of the air quality standard and show no exceedance of the criteria (EPA 2005a, 2005b).

No additional parameters were monitored/reported from 1994 through 1997. No consistent air quality monitoring specific to the project area is available after 1997 (personal communication with K. Symons, UDAQ, May 2005). The project area is located in an area designated as attainment or unclassified for all pollutants (personal communication with K. Symons, UDAQ, May 2005; EPA 2005a).

3.3.2 Indicators

Indicators of the affected environment specific to air quality include particulate (PM_{10} and $PM_{2.5}$) concentrations (based on projected areas of disturbance, fugitive dust potential, and climatological information) as well as combustion byproduct emissions from heavy equipment (based on standardized emissions information, vehicle type and number, and operating durations). The following subsections analyze the potential effects of the alternatives on air quality within the project area and the adjacent airshed.

3.3.3 Environmental Consequences of Alternative A: No Action

The No Action Alternative includes continued dredging in the Coal Creek channel, when and where necessary. Additional erosion control and streambank hardening activities may be conducted as required under this alternative; however, no additional on-site construction is currently planned. No additional parkway improvements would be conducted under this alternative.

3.3.3.1 Direct and Indirect Effects

The direct effects of the No Action Alternative on air quality within and adjacent to the project area would be minimal. Direct, adverse effects would include emissions from heavy equipment operated during dredging and particulate matter generated from soil disturbance following extreme flood flows. At the time of a flooding event, soils are expected to be damp and generate little or no particulate. Indirect, adverse effects include an increased potential for short-term increases in particulate (dust) following the removal of existing vegetation after an extreme flood event. All adverse effects on air quality are projected to be minor and of short duration.

Pollutant transport and dispersion patterns within and adjacent to the project area would not likely transport pollutants into or near Zion or Bryce Canyon National Park. Actions within the project area are not projected to result in any adverse impacts to these Class I areas.

No appreciable, long-term air-quality effects are projected under this alternative.

3.3.3.2 Mitigation

Mitigation measures should include use of appropriately maintained vehicles that meet standardized emissions requirements, and timely reseeding/revegetation of the affected locations in the project area following major flooding events.

3.3.4 Environmental Consequences of Alternative B: Relocate Main Street Diversion

Alternative B proposes relocating the Main Street Diversion to near 200 East and the removal of the irrigation diversion/drop structure currently in use. Implementation of this alternative would require approximately 3,250 feet of pipeline to be installed, flood and slope/grading-related channel modifications from Center Street to I-15, and the continuation of periodic dredging as necessary. Under this alternative, the parkway would be extended to Airport Road on both sides of the river and landscaped/vegetated. Parkway Option B1 proposes a crosswalk at Main Street Bridge. Parkway Option B2 proposes to access existing sidewalks from the pedestrian bridge at 400 North to cross Main Street and avoid additional property acquisition.

3.3.4.1 Direct and Indirect Effects

Operation of construction equipment and vehicles and soil/surface disturbance associated with the relocation of the Main Street Diversion, pipeline installation, and parkway extension could have direct and indirect, adverse effects on air quality in the project area during the construction process. Improvements in the channel capacity and erosion-resistance could have indirect, long-term, beneficial effects on air quality.

Direct, adverse effects include emissions from increased heavy equipment and vehicle operation, as well as particulate generated from soil and sediment disturbance during construction. Indirect, adverse effects include an increased potential for short-term increases in particulate (dust) during the time between the removal of existing vegetation and the establishment of new/replaced vegetation. All direct, adverse effects on air quality are projected to be minor and of short duration.

Pollutant transport and dispersion patterns within and adjacent to the project area will not likely transport pollutants into or near Zion or Bryce Canyon National Parks. Because the short-term actions within the project area are projected to produce insignificant to very small incremental increases in pollutant concentrations, no adverse impacts are projected for these Class I areas.

No appreciable, long-term air-quality effects are projected under this alternative.

3.3.4.1.1 CONSTRUCTION EQUIPMENT EMISSIONS

Relocating the Main Street Diversion, installing a new pipeline, and extending the parkway would have direct, adverse effects on air quality specific to the operation of construction equipment and vehicles. Vehicle exhaust generated by construction equipment and vehicles contains hydrocarbons, combustion byproducts, and particulate emissions.

An estimation of exhaust emissions was completed using EPA emission factors (EPA 2004) and a calculational model. For the model, the estimates assumed the use of diesel-powered equipment of model year 1997 or newer, working in a section approximately 1,300 feet long and 500 feet wide with an upper dispersion boundary of 50 feet. Based on the previous discussion of local wind conditions, a conservative assumption of 3 mph winds was applied. Work activity was generally assumed to occur during the 12-hour period from 7 a.m. to 7 p.m. A six-month construction season was assumed for calculation of conservative annual concentrations. A total of 10 construction vehicles operating on-site at any one time were assumed. Particulate matter smaller than 2.5 microns ($PM_{2.5}$) was assumed to represent 97% of the particulate matter in exhaust and crankcase emissions (EPA 2004), and it was also assumed that this relationship applied to the calculated emissions loading. $PM_{2.5}$ thresholds were used to evaluate estimated particulate concentrations.

The equation used to calculate emissions for a pollutant (including NAAQS constituents: particulates, carbon monoxide [CO] and nitrogen dioxide [NO_2]) employed standardized emission factors based on vehicle age and engine size. The equation also accounted for engine load, equipment population, hours of use, and activity level (EPA 2003c).

An *emission factor* is defined by the EPA as the average emissions of a pollutant from a specific equipment category type and is usually expressed in grams per horsepower-hour (g/hp-hr). Equipment population was the number of pieces of equipment estimated to be in use for project work at any one time. Hours of use were assumed to be full time over the 12-hour daily work period, seven days per week. This is, of course, an overestimation of emissions for the majority of construction activity, but it would be representative of periods of intense activity and, therefore, serves as a conservative estimate of critical conditions (EPA 2003c).

If older equipment (pre-1997) is used for the project work, it should be understood that emissions could be as much as two times higher than those calculated for this assessment (EPA 2003c). However, it is unlikely that the entire population of equipment used will be older than 1997. The conservative assumptions made for hours of use, total equipment population, and wind conditions are expected to sufficiently protect air quality from project-related exhaust emissions.

Using the methodology and assumptions outlined previously, the maximum potential CO emissions from construction equipment and vehicles were estimated to be 73.9 $\mu g/m^3$ (1-hour). Background concentration information was not available, but project-related concentrations are well below the applicable NAAQS for CO (40,000 $\mu g/m^3$).

The maximum potential NO_2 concentrations during project construction were modeled using standardized emission factors with an adjustment factor of 0.75 (in accordance with standard EPA methodology, *Federal Register* 60:153, p. 40469, August 9, 1995) to convert the modeled NO_x concentration to NO_2. The maximum-modeled annual NO_2 concentration was 90.3 $\mu g/m^3$ (annual). Background concentration information is not available, but project-related concentrations are below the applicable NAAQS of 100 $\mu g/m^3$ (annual).

The maximum potential PM_{10} emissions from construction equipment and vehicles were estimated at 0.4 $\mu g/m^3$ (24-hour) and 0.2 $\mu g/m^3$ (annual). In the absence of more current data, the background PM_{10} concentrations measured between 1994 and 1997 were assumed to be representative of existing background conditions. When background PM_{10} concentrations are added for the annual mean of 24-hour average concentration (19.3 $\mu g/m^3$ for 1994 through 1997), the total concentration is 19.7 $\mu g/m^3$ for the 24-hour average. This concentration is well below the applicable NAAQS of 150 $\mu g/m^3$ (24-hour).

The maximum potential $PM_{2.5}$ emissions from construction equipment and vehicles were estimated at 11.6 $\mu g/m^3$ (24-hour) and 5.8 $\mu g/m^3$ (annual). Background concentration information was not available, but project-related concentrations are well below the applicable NAAQS of 65 $\mu g/m^3$ (24-hour).

3.3.4.1.2 Soil and Sediment Disturbance

Relocating the Main Street Diversion, installing a new pipeline, and extending the parkway would have direct, adverse effects on air quality specific to soil and sediment disturbance. Windborne particulate from disturbed soils, stockpiles, vegetation removal, and increased traffic on soil surfaces could result in elevated levels of fugitive dust and associated particulates.

Soil/sediment disturbance was estimated at 23.87 acres for Alternative B (24.41 acres for Parkway Option B1 and 24.53 acres for Parkway Option B2). While this area includes the Coal Creek stream channel and its impact corridor, it also includes a projected buffer on either side of the stream channel and pipeline corridors that, in some areas, have a low to nonexistent probability of being disturbed or generating project-related dust. Therefore, the estimation of particulate emissions from this area is a conservative one and overly protective of air quality resources; the actual area of disturbance will most likely be considerably less than the total estimated acres.

An estimation of the potential for dust generation was completed using EPA emission factors (EPA 1995; WRAP 2004) and a calculational model. The equation used to calculate dust generation (including NAAQS constituents PM_{10} and $PM_{2.5}$) employed standardized emission factors based on soil type, vehicle type and activity level, and vehicle distance traveled (EPA 1995).

Soils in the project area have been characterized as having low to moderate wind-erodibility. For Alternative B (both options) approximately 63% to 65% of the soils were projected to have low wind-erodibility, 15% to 17% were projected to have moderate wind-erodibility, and 20% of the soils had no associated wind-erodibility data.

As all construction at all sites along the channel is not likely to be undertaken simultaneously, for the model, the estimates assumed that total soil disturbance at any given time within the construction period would not exceed an area approximately 1,300 feet long and 500 feet wide (approximately two thirds of the total project area). A conservative assumption of 3 mph winds was applied. Work activity was assumed to occur during the 12-hour period from 7 a.m. to 7 p.m. A total of 10 construction vehicles operating on-site at any one time was assumed; four of these were stationary (e.g., compressors, generators, pumps and similar equipment), and the others were assumed to be two heavy (6 tons or more), two mid-range (3 tons), and two light duty (2 tons) mobile vehicles. Soil moisture content of 5% or less and soil silt content of 5% were assumed. Soil silt content was approximated from the relative percent silty soils present in each alternative footprint. Mean vehicle speed on the construction site was assumed to be 10 mph. It was assumed that all six mobile vehicles would be working at any one time on site. This is, of course, an overestimation of dust emissions for the majority of construction activity, but it would be representative of periods of intense activity and, therefore, serves as a conservative estimate of critical conditions.

It was assumed that watering of all exposed disturbance areas (e.g., work areas, staging areas, and roads) on the construction site would occur twice daily during the construction period. Although soils within the project area exhibit variation in wind-erodibility, a conservative control efficiency of 37% for all exposed/graded areas and 3% for all well-traveled roadways was assumed as a result of the twice daily watering (CEQA 2002) to allow a protective estimate of critical conditions.

Using the methodology and assumptions outlined previously, the maximum potential PM_{10} emissions from soil and sediment disturbance related to construction equipment and vehicle operations were estimated at 45.6 $\mu g/m^3$ (24-hour). When background PM_{10} concentrations are added for the annual mean of 24-hour average concentration (19.3 $\mu g/m^3$ for 1994 through 1997), the total concentration is 64.9 $\mu g/m^3$ for the 24-hour average. This concentration is well below the applicable NAAQS of 150 $\mu g/m^3$ (24-hour).

The maximum potential $PM_{2.5}$ emissions from soil and sediment disturbance were estimated at 7.0 $\mu g/m^3$ (24-hour). Background concentration information was not available, but project-related concentrations are well below the applicable NAAQS of 65 $\mu g/m^3$ (24-hour).

Using the methodology and assumptions outlined previously, *and* assuming that watering of all exposed disturbance areas (e.g., work areas, staging areas, and roads) on the construction site would occur with adequate frequency to keep soils moist during working hours, a control efficiency of 75% for all exposed/graded areas and 10% for all well-traveled roadways was assumed (CEQA 2002). With this additional dust abatement mechanism in place, the maximum potential PM_{10} emissions from soil and sediment disturbance were estimated at 21.6 $\mu g/m^3$ (24-hour). When background PM_{10} concentrations are added for the annual mean of 24-hour average concentration (19.3 μg/m^3 for 1994 through 1997), the total concentration is 40.9 μg/m^3 for the 24-hour average. This concentration is well below the applicable NAAQS of 150 μg/m^3 (24-hour).

The maximum potential $PM_{2.5}$ emissions from soil and sediment disturbance under this scenario were estimated at 3.3 μg/m^3 (24-hour). Background concentration information was not available, but project-related concentrations are well below the applicable NAAQS of 65 μg/m^3 (24-hour).

In addition to construction-specific actions under Alternative B, some additional post-construction particulate (dust) emissions are projected to occur on a short-term basis due to loss of vegetation within the construction and staging areas. Given appropriate soil stabilization and revegetation measures, these emissions are projected to be minimal to negligible. No appreciable, long-term, adverse air-quality effects are projected under this alternative.

3.3.4.1.3 Air Quality Impacts Summary

No measurable CO emissions from soil disturbance are projected to occur under this alternative. Therefore, estimated CO emissions from construction equipment and vehicles (73.9 μg/m^3 [1-hour]) are assumed to be representative of project-related emissions. Background concentration information is not available, but total estimated, project-related concentrations are well below the applicable NAAQS for CO of 40,000 μg/m^3.

No measurable NO_2 emissions from soil disturbance are projected to occur under this alternative. Therefore, estimated NO_2 emissions from construction equipment and vehicles (90.3 μg/m^3 [annual]) are assumed to be representative of project-related emissions. Background concentration information is not available, but project-related concentrations are below the applicable NAAQS of 100 μg/m^3 (annual).

The summed, maximum potential PM_{10} emissions from construction equipment and vehicle operations, as well as those from soil disturbance, were estimated to be 46.0 μg/m^3 (24-hour). When background PM_{10} concentrations are added for the annual mean of 24-hour average concentration (19.3 μg/m^3 for 1994 through 1997), the total concentration is 65.3 μg/m^3 for the 24-hour average. This concentration is below the applicable NAAQS of 150 μg/m^3 (24-hour).

The summed, maximum potential $PM_{2.5}$ emissions from construction equipment and vehicle operations, as well as those from soil disturbance, were estimated to be 18.6 μg/m^3 (24-hour). Background concentration information was not available, but project-related concentrations are well below the applicable NAAQS of 65 μg/m^3 (24-hour).

With the additional dust abatement mechanism in place (i.e., watering), the summed maximum potential PM_{10} emissions from construction equipment and vehicle operations, as well as those from soil disturbance, were estimated to be 22.0 μg/m^3 (24-hour). When background PM_{10} concentrations are added for the annual mean of 24-hour average concentration (19.3 µg/m^3 for 1994 through 1997), the total concentration is 41.3 µg/m^3 for the 24-hour average. This concentration is well below the applicable NAAQS of 150 µg/m^3 (24-hour).

With the additional dust abatement mechanism in place (i.e., watering), the summed maximum potential $PM_{2.5}$ emissions from construction equipment and vehicle operations, as well as those from soil disturbance, were estimated to be 14.9 µg/m^3 (24-hour). Background concentration information was not available but project-related concentrations are well below the applicable NAAQS of 65 µg/m^3 (24-hour).

Given the preceding analyses, the effects of Alternative B on air quality within and adjacent to the project area are projected to be minimal. Direct, adverse effects include emissions from heavy equipment operation and particulate generated from soil and sediment disturbance during and immediately following construction. Indirect, adverse effects include an increased potential for short-term generation of particulate (dust).

No exceedance of NAAQS is projected under this alternative (Table 3.4) from either project-related emissions or as an accumulation of project-related emissions and existing background concentrations (where known). No appreciable, long-term, adverse air-quality effects are projected under this alternative.

Table 3.4. Sum of Construction-related Air Quality Emissions Estimated to Occur Under Alternative B (µg/m^3)

	Carbon Monoxide (CO) (1-hour)	Nitric Oxide (NO_2) (annual)	Particulate PM_{10} (24-hour)	Particulate $PM_{2.5}$ (24-hour)
NAAQS	***40,000***	***100***	***150***	***65***
Background	-	-	19.3	-
Exhaust Emissions	73.9	90.3	0.4	11.6
Soil Disturbance Emissions	negligible	negligible	45.6	7.0
Soil Disturbance Emissions with Additional Watering	negligible	negligible	21.6	3.3
Total Emissions from Project-Related Activity	73.9	90.3	46.0	18.6
Total Emissions from Project-Related Activity with Additional Watering	73.9	90.3	22.0	14.9

3.3.4.2 Mitigation

The magnitude of air quality emissions specific to this alternative (projected to be negligible) can be further minimized by surface stabilization techniques, by replacing/ improving surface vegetation, and by equipment and vehicle air emissions restrictions imposed by regulatory agencies and management authorities.

3.3.5 Environmental Consequences of Alternative C: Replace Main Street Diversion

Alternative C proposes modifying the Main Street Diversion by removing half the drop of the irrigation diversion currently in use (approximately 4 feet). Implementation of this alternative would require approximately 3,000 feet of pipeline to be installed, flood and slope/ grading-related channel modifications from Center Street to west of I-15, and the continuation of periodic dredging as necessary. Under this alternative, the parkway would be extended to Airport Road, on both sides of the river where possible, and landscaped/vegetated. Parkway Option C1 would construct an elevated pedestrian pathway under the Main Street Bridge. Parkway Option C2 would construct a large box culvert for pedestrian use north of the bridge and under Main Street.

3.3.5.1 Direct and Indirect Effects

Direct and indirect effects of Alternative C are projected to be similar to those described for Alternative B. No appreciable, long-term air-quality effects are projected under this alternative.

3.3.5.1.1. Construction Equipment Emissions

For Alternative C (all options), construction equipment-related air quality effects are projected to be similar to those detailed for Alternative B.

3.3.5.1.2 Soil and Sediment Disturbance

Soil/sediment disturbance was estimated to be 24.89 acres for both parkway options for Alternative C. The North Field Canal option would add 1.33 acres of soil/sediment disturbance (for a total of 26.22 acres). The elements used to estimate air quality effects from soil/ sediment disturbance for Alternative C were the same as those described under Alternative B. Therefore, the estimation of particulate emissions from this area is a conservative one and overly protective of air quality resources; the actual area of disturbance will most likely be considerably less than the total estimated acres.

For Alternative C (all options), approximately 50% of the soils are projected to have low wind erodibility, 30% are projected to have moderate wind erodibility, and 20% of the soils have no associated wind erodibility data. Soil moisture content of 5% or less and soil silt content of 5% was assumed for the modeled emissions. All other parameters were assumed to be the same as in Alternative B. Other assumptions—that total soil disturbance within the project area would not exceed two thirds of the total affected area at any one time within the construction period, and that watering of all exposed disturbance areas (e.g., work areas, staging areas and roads) on the construction site would occur twice daily during the construction period—apply to activities associated with Alternative C.

Using the methodology and assumptions outlined in the discussion for Alternative B, the maximum potential PM_{10} emissions from soil and sediment disturbance were estimated to be 104.0 $\mu g/m^3$ (24-hour). When background PM_{10} concentrations are added for the annual mean of 24-hour average concentration (19.3 $\mu g/m^3$ for 1994 through 1997), the total concentration is 123.3 $\mu g/m^3$ for the 24-hour average. This concentration is well below the applicable NAAQS of 150 $\mu g/m^3$ (24-hour).

The maximum potential $PM_{2.5}$ emissions from soil and sediment disturbance were estimated to be 15.9 $\mu g/m^3$ (24-hour) under Alternative C. Background concentration information was not available, but project-related concentrations are well below the applicable NAAQS of 65 $\mu g/m^3$ (24-hour).

Assuming watering controls and control efficiencies similar to those outlined for Alternative B, the maximum potential PM_{10} emissions from soil and sediment disturbance were estimated to be 49.3 $\mu g/m^3$ (24-hour) under Alternative C. When background PM_{10} concentrations are added for the annual mean of 24-hour average concentration (19.3 $\mu g/m^3$ for 1994 through 1997), the total concentration is 68.6 $\mu g/m^3$ for the 24-hour average. This concentration is well below the applicable NAAQS of 150 $\mu g/m^3$ (24-hour).

The maximum potential $PM_{2.5}$ emissions from soil and sediment disturbance under this scenario (i.e., assuming watering controls and control efficiencies; see Alternative B) were estimated at 7.6 $\mu g/m^3$ (24-hour). Background concentration information was not available, but project-related concentrations are well below the applicable NAAQS of 65 $\mu g/m^3$ (24-hour).

Post-construction particulate (dust) emissions are projected to be similar to those described for Alternative B.

Due to the conservative nature of the assumptions used in estimating effects on air quality from Alternative C, the small incremental increase in acreage specific to the North Field Canal option is expected to have no discernable impact on overall air quality provided that other assumptions remain valid (e.g. total working area not to exceed two thirds of the total affected area at any one time within the construction period) and that appropriate mitigation measures are applied.

3.3.5.1.3 AIR QUALITY IMPACTS SUMMARY

No measurable CO or NO_2 emissions from soil disturbance are projected to occur under this alternative. Therefore, estimated emissions from construction equipment and vehicles are assumed to be representative of project-related emissions; all are below the applicable NAAQS as described for Alternative B.

The summed, maximum potential PM_{10} emissions from construction equipment and vehicle operations, as well as those from soil disturbance, were estimated to be 104.4 $\mu g/m^3$ (24-hour). When background PM_{10} concentrations are added for the annual mean of 24-hour average concentration (19.3 $\mu g/m^3$ for 1994 through 1997), the total concentration is 123.7 $\mu g/m^3$ for the 24-hour average. This concentration is below the applicable NAAQS of 150 $\mu g/m^3$ (24-hour).

The summed, maximum potential $PM_{2.5}$ emissions from construction equipment and vehicle operations, as well as those from soil disturbance, were estimated to be 27.5 $\mu g/m^3$ (24-hour). Background concentration information was not available, but project-related concentrations are well below the applicable NAAQS of 65 $\mu g/m^3$ (24-hour).

With the additional dust abatement mechanism in place (i.e., watering), the summed, maximum potential PM_{10} emissions from construction equipment and vehicle operations, as well as those from soil disturbance, were estimated to be 49.7 $\mu g/m^3$ (24-hour). When background PM_{10} concentrations are added for the annual mean of 24-hour average concentration (19.3 $\mu g/m^3$ for 1994 through 1997), the total concentration is 69.0 $\mu g/m^3$ for the 24-hour average. This concentration is well below the applicable NAAQS of 150 $\mu g/m^3$ (24-hour).

With the additional dust abatement mechanism in place (i.e., watering), the summed, maximum potential $PM_{2.5}$ emissions from construction equipment and vehicle operations, as well as those from soil disturbance, were estimated to be 19.2 $\mu g/m^3$ (24-hour). Background concentration information was not available but project-related concentrations are well below the applicable NAAQS of 65 $\mu g/m^3$ (24-hour).

Given the preceding analyses, the effects of Alternative B on air quality within and adjacent to the project area are projected to be minimal. Direct, adverse effects include emissions from heavy equipment operation and particulate matter generated from soil and sediment disturbance during and immediately following construction. Indirect, adverse effects include an increased potential for short-term generation of particulate (dust).

No exceedance of NAAQS is projected under this alternative (Table 3.5) from either project-related emissions or as a result of project-related emissions and existing background concentrations (where known). No appreciable, long-term, adverse air-quality effects are projected under this alternative.

Table 3.5. Sum of Construction-related Air Quality Emissions Estimated to Occur Under Alternative C (μg/m³)

	Carbon Monoxide (CO) (1-hour)	Nitric Oxide (NO_2) (annual)	Particulate PM_{10} (24-hour)	Particulate $PM_{2.5}$ (24-hour)
NAAQS	***40,000***	***100***	***150***	***65***
Background	-	-	19.3	-
Exhaust Emissions	73.9	90.3	0.4	11.6
Soil Disturbance Emissions	negligible	negligible	104.0	15.9
Soil Disturbance Emissions with Additional Watering	negligible	negligible	49.3	7.6
Total Emissions from Project-Related Activity	73.9	90.3	104.4	27.5
Total Emissions from Project-Related Activity with Additional Watering	73.9	90.3	49.7	19.2

Similar to Alternative B, post-construction particulate (dust) emissions due to loss of vegetation within the construction and staging areas are projected to occur on a short-term basis, but given appropriate soil stabilization and revegetation measures, they are projected to be minimal to negligible.

3.3.5.2 Mitigation

Mitigation measures for Alternative C are similar to those discussed for Alternative B.

3.4 Geology and Soils

This section describes the geological setting and soils of the project area and the impacts that may occur under each of the alternatives. This description of the affected environment for geology and soils provides a basis for assessing if and how the Proposed Action or alternatives could cause beneficial or adverse changes to the physical environment in the project area. For example, modification of the Coal Creek channel morphology could influence bank stability that could, in turn, affect bank erosion and increase stream sedimentation.

The geology and soils found within the Coal Creek watershed are important resources that have shaped the character of the region and affect other resources within the project area. The combined influence of easily weathered bedrock within the upper watershed and the structural control of the Hurricane Fault have formed the current Cedar City alluvial fan and have produced the present-day channel conditions of Coal Creek. Geology and soils directly relate to surface and groundwater conditions within the project area and subsequently affect vegetation, wetland, riparian, and wildlife resources.

Surface and groundwater resources are affected by geology and soils due to the combined forces of sediment supply and local climate. The easily weathered rock units within Cedar Canyon have historically provided sediment to the Coal Creek stream system. Human use of Cedar Canyon—including grazing, timber harvest, coal mining, and road building—has changed the natural characteristics of the Coal Creek watershed. The loss of vegetative cover to grazing and timber harvest has also contributed to conditions where these erosive rocks and soils are more easily transported during summer thunderstorms. Channelization due to road building and impoundment of sediments behind diversion structures has altered the natural geologic environment as well.

Recreation, visual, and socioeconomic resources are affected by the geology of the area because many people come to Cedar City and its surrounding environment just to visit the unique natural features. Detailed discussions of recreation, visual, and socioeconomic resources are located in Sections 3.10 and 3.11.

3.4.1 Existing Conditions

This section describes the existing conditions of the geology and soils of Cedar Canyon and the Coal Creek alluvial fan within the project area, with an emphasis on those aspects of geology and soils that may be affected by one or more of the alternatives. The discussion presents baseline conditions of the Coal Creek watershed (Figure 3.3), including bedrock geology, sediment dynamics, and surface and groundwater movement patterns. These conditions have historically controlled the timing and amount of flooding within the Coal Creek floodplain. Issues directly related to the floodplain and groundwater recharge are discussed in Section 3.5, Surface and Groundwater Resources.

The discussion of geology is based on recent studies of the Cedar Valley, including a study published in 2002 by the Utah Geological Survey (UGS) titled "The Geology of Cedar Valley, Iron County, Utah, and its Relation to Ground-water Conditions" by Hugh Hurlow (2004). The discussion of soil resources is based on information found in the Soil Survey of Iron-Washington Area, Utah, Parts of Iron, Kane, and Washington Counties (NRCS 2001) and corresponding data found within the Soil Survey Geographic Database (SSURGO 2005).

Figure 3.3 shows the general watershed features, including rock type, structural features, precipitation contours, and watershed boundaries. The Hurricane Fault and the erosive sedimentary rocks in Cedar Canyon are the main structural features within the watershed that have controlled sediment delivery to the Cedar City alluvial fan. Figure 3.4 shows soil units mapped within the project area.

3.4.1.1 Geologic Setting

The aspects of geology that most directly influence flood flows and sediment dynamics in Coal Creek are the erosivity of bedrock units and their historical movement along the Hurricane Fault. As evidenced by the large amount of sediment that has historically and continually moved through Coal Creek and the highly eroded Cedar Breaks National Monument on the Markagunt Plateau, erosion is presently and actively occurring on many rock units. The relative movements of Cedar Valley (down) and the Markagunt Plateau (up) presently control the amount of sediment that is shed from the highlands to the east of the Hurricane Fault.

Coal Creek is the primary source of groundwater recharge for the Cedar Valley alluvial-fan aquifer (Hurlow 2002). Intense summer thunderstorms and spring snowmelt account for the majority of the surface water flow in Coal Creek. Much of this surface water enters the groundwater through coarse deposits close to the mouth of Cedar Canyon, as evidenced by groundwater-level contours from Bjorklund and others (1978). The UGS Special Study 109 (Hurlow 2002) contains figures with groundwater level contours, precipitation gradients, and topographic features.

The Markagunt Plateau is topographically higher than surrounding mountains and therefore receives the greatest amount of precipitation (approximately 40 inches per year) in the Coal Creek watershed, whereas the Cedar Valley only receives 10–12 inches of precipitation annually. Precipitation falls primarily in the form of winter snow and during summer thunderstorms, which wash considerable amounts of sediment down Coal Creek. Water readily carries sediment out of Cedar Canyon and onto the Cedar Valley alluvium. Most of the runoff from Coal Creek infiltrates into the ground or is drawn on for consumptive use, except during extreme precipitation events (Hurlow 2002).

3.4.1.1.1 Bedrock

The majority of the rocks in the Coal Creek watershed are sedimentary in origin. These rocks formed under a variety of conditions and include sandstones, siltstones, mudstones, and limestones. Some rock units also contain layers of gypsum, which influences water quality. The following table (Table 3.6) contains descriptions and thicknesses of rock units in the project area. In terms of this project, the most important characteristic of many of these units is that they are highly erodible sedimentary rocks.

3.4.1.1.2 Surface Materials

The surface materials within the project area are alluvial in origin. Historically, Coal Creek has transported a large amount of sediment from Cedar Canyon. The sediment was deposited as alluvium radiating out from the mouth of Cedar Canyon. The vertical movement of the Hurricane Fault controls the base level of Coal Creek and, thus, the amount of sediment deposited as alluvium (Eisinger 1998). Generally, coarser materials are deposited close to

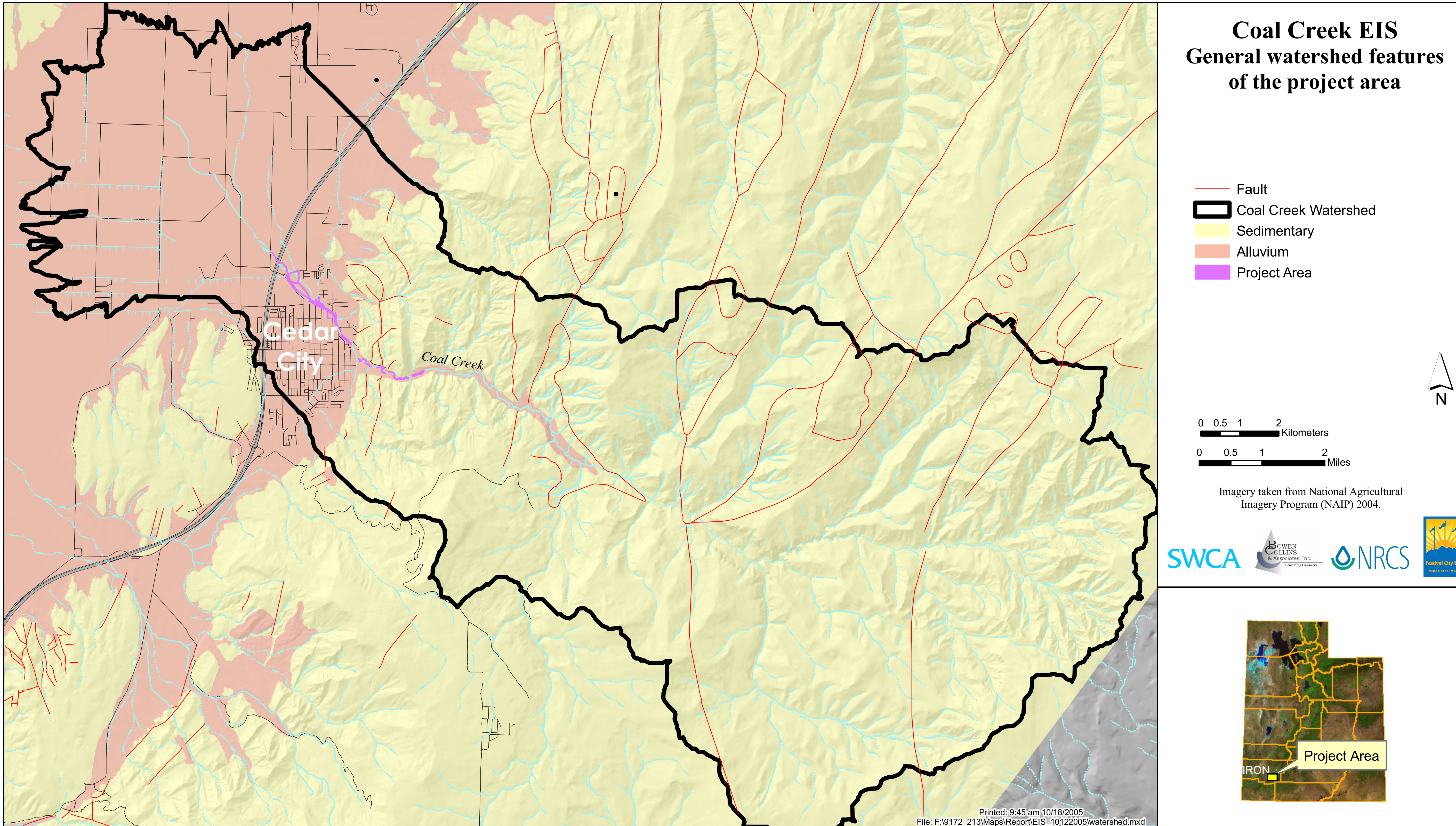


Figure 3.3. General watershed features of the project area.

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Figure 3.4. All soil units mapped in the project area.

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Table 3.6. General Stratigraphy of Rock Units Within the Coal Creek Watershed, Adapted from Hintze (1998), Averitt (1962), and Bjorklund and Others (1978)

Age	Geologic Formation	Description	Thickness (feet)
Quaternary	Alluvium	Gravel, sand, silt, and clay.	0-3,000+
	Alluvial-fan deposits	Poorly sorted gravel, sand, silt and clay; gradational with Quaternary alluvium.	Variable depth
Tertiary	Volcanic rocks	Basalt, rhyolite, and tuffs.	Variable depth
	Claron Formation	Thin- to thick-bedded sandstone, shale, and limestone.	Variable depth
	Grand Castle Formation	Interbedded sandstone and conglomerate.	Variable depth
Cretaceous	Iron Springs Formation	Thin-bedded to massive sandstone with some carbonaceous shale and coal with some conglomerate beds and shale at base.	Variable depth
	Wahweap and Straight Cliffs Sandstones	Fine grained sandstone and siltstone containing some coal and organic rich fossiliferous seams.	600-1,200
	Tropic Shale	Shale.	700-800
	Dakota Formation	Shale with some sandstone.	400-600
Jurassic	Carmel Formation	Thin-bedded shaley limestone, sandstone, siltstone, mudstone with gypsum, or massive gypsum beds with sandstone and mudstone.	550-1,300
	Navajo Sandstone	Medium-grained sandstone with large-scale cross-bedding and minor limestone deposits.	1,600-2,000
	Kayenta Formation	Mudstone and silty mudstone.	Variable depth
	Moenave Formation	Siltstone and mudstone overlain by massive sandstone with cross-bedding.	Variable depth
Triassic	Chinle Formation	Basal conglomerate overlain by mudstone and siltstone.	300-500
	Moenkopi Formation	Siltstone and mudstone.	1,600-1,800

the mouth of the canyon and finer materials are transported farther away from the canyon to be deposited in layered deposits. Flooding has reworked sediments, and human influences have altered the dynamics of sediment transport within the river system.

Irrigation diversion structures, grade control structures, and bridges in the project area presently affect sediment deposition and erosion. Channelization tends to increase water velocity, thus augmenting the carrying capacity of the water and causing further incision. Sediment deposition immediately upstream of the old UP&L drop structure, the Main Street Diversion, and the Woodbury Diversion creates a situation where the capacity of the stream to carry sediment is greater than sediment supply, therefore increasing entrenchment of the stream downstream of these areas.

The present trends in the watershed indicate that sediment yield from the watershed is mostly fine material. The majority of the coarse material within the project area is likely supplied from the eroding banks within the project area (personal communication with B. Rasely, NRCS, May 2005).

3.4.1.2 Soils

Soils within the project area are formed primarily in Quaternary alluvial sediments derived from the Coal Creek watershed. Therefore, within the project area, soils are generally deep to very deep (40 to more than 60 inches soil depth), with the exception of soils up the Cedar Canyon, near canyon walls, that have a depth to bedrock as shallow as 10 inches. Project area soils receive approximately 12–16 inches of precipitation annually (xeric soil moisture regime) and range in temperature from 45 to 52°F (mesic soil temperature regime).

3.4.1.2.1 Soil Erosion

It is important to examine the erodibility of soils within the project area because soil loss can reduce plant productivity and contribute to stream sedimentation (which, in turn, results in increased maintenance of downstream water conveyance infrastructure). Wind-borne dust can also reduce local air quality.

Soils within the project area were evaluated for water erodibility based on the erodibility constant and percent slope for each soil mapping unit. Soil mapping units with an erodibility constant of 0.32 or greater and slopes greater than 10% were considered susceptible to water erosion. Based on these parameters, 57.8 acres of soils within the project area are susceptible to water erosion.

Soil wind erodibility was measured using the soil's wind erodibility group (WEG). The WEG is a numeric scale ranging from 1 to 8, where soils in WEG 1 and 2 have low susceptibility to wind erosion, WEG 3, 4, and 4L soils have moderate susceptibility, and WEG 5, 6, 7, and 8 soils have high susceptibility. The propensity for soil erosion is also contingent on the soil(s) being exposed (i.e., the soils have been cleared of vegetation). Rock outcrops and water were mapped as units containing "no data". Based on these parameters, soils with high susceptibility to wind erosion do not occur within the project area. Approximately 11.7 acres of project area soils are moderately susceptible to wind erosion, and 56.7 acres are slightly susceptible to wind erosion. The majority of soils susceptible to erosion are situated along the Coal Creek stream channel.

3.4.1.2.2 Gypsum-bearing Soils

Gypsum-bearing soils are usually structurally stable when they receive precipitation consistent with their location (e.g., 12–16 inches per annum). However, problems may arise when gypsum-bearing soils are irrigated excessively. Gypsum is a water-soluble mineral, and excessive irrigation can lead to the removal of gypsum from the soil profile. Subsequently, soils that lose gypsum can deflate, resulting in ground subsidence. In turn, subsidence can result in an uneven ground surface, and in severe cases, can result in the cracking and settling of the structural foundation. This problem typically occurs in fine- and loamy-textured soil layers containing more than 5% gypsum by volume. Gypsum-bearing soils with high rock fragment content (called skeletal soils) are less susceptible to subsidence, because the rock fragments provide the bulk of the soil's structural integrity. However, skeletal soils with greater than 8–10% gypsum by volume are susceptible to subsidence if heavily irrigated. This subsidence can also result in economic impacts associated with damage to structures in urbanized areas.

The Coal Creek project area contains one soil mapping unit with a high gypsum content, Map Unit 310 (Ashdown loam, gypsiferous substratum, 2–5% slopes). This soil is located along Coal Creek between the mouth of Cedar Canyon and Main Street and comprises 6.4 acres of the project area.

3.4.2 Indicators

Indicators of the affected environment as they relate to geology and soils include bank stability and sediment dynamics, wind and water erodibility, and soil gypsum content. Channel capacity and water velocity, also related to geology and soils, are discussed in Section 3.5, Surface and Groundwater Resources. As part of this EIS analysis, surveys have been completed, and bank stability has been estimated for numerous cross sections along Coal Creek. These cross sections also depict the water levels for both the FEMA 100-year flood event and a 2,500 cfs flow event.

The effects of the alternatives on sediment dynamics and bank stability within the project area will be discussed in qualitative terms. Potential impacts from soil erosion and gypsiferous soils will be quantified as acreages of these soil types directly affected by the alternatives. Table 3.7 provides a summary of action alternative impact acreage by soil type. Additional details regarding these alternative impacts are given in Sections 3.4.3 through 3.4.5 below.

3.4.3 Environmental Consequences of Alternative A: No Action

3.4.3.1 Direct and Indirect Effects

There would be no construction-related, short-term effects on soil resources under the No Action Alternative. However, there would be continued, long-term, major, adverse affects on sediment dynamics and bank stability within the project area. Sediment would continue

Table 3.7. Action Alternative Impacts by Soil Type (acres)

Soil Type	Alt B Pkwy Option 1	Alt B Pkwy Option 2	Alt C Pkwy Options 1 and 2	Alt C Pkwy Options 1 and 2 with North Field Canal Option
Anabella very gravelly loam, 2-15% slopes -Moderate wind erosion -High water erosion	15.8	15.4	15.9	16.4
Ashdown loam, gypsiferous substratum, 2-5% slopes -Moderate wind erosion -High water erosion	0.8	0.8	1.2	2.0
Squawcave silt loam, 2-15% slopes -Moderate wind erosion -High water erosion	1.2	1.7	1.3	1.3
Badland-Moondog-Rock outcrop complex, 20-70% slopes -No data on wind erosion -High water erosion	4.9	4.9	4.9	4.9
Soutin loam, 2-15% slopes -Moderate wind erosion -Not at risk for water erosion	0.8	0.8	0.8	0.8
Medburn sandy loam, 0-2% slopes -Not at risk for water erosion	1.1	1.1	1.1	1.1
Total	**24.5**	**24.6**	**25.0**	**26.5**

to be deposited under the Main Street Bridge, which would continue to contribute to the flooding effects discussed in Section 3.5, Surface and Groundwater Resources. Continual maintenance would be necessary to remove sediment from the 1,000-foot middle reach above the Main Street Diversion. Under the No Action Alternative, the present conditions would remain and sediment would continue to be deposited above the historical bridge constriction, Main Street Diversion, and the Woodbury Split. Sediment buildup at these areas would cause continued flooding in these locations, as well as problems for infrastructure (see Section 3.11, Socioeconomics and Environmental Justice).

With respect to soil resources, bank erosion would continue to occur under the No Action Alternative, and sloughing and stream sedimentation would occur, resulting in continued, negative, adverse impacts to water conveyance infrastructure (e.g., agricultural canals and ditches) and stream channel morphology. Exposed, incised banks would also be susceptible to wind erosion. This alternative would have no direct effect on gypsiferous soils with respect to soil subsidence.

No erosion control modifications would occur beyond the present efforts by Cedar City and other public and private entities. This would have a direct, major, adverse effect on bank stability, in that the banks would remain at the current level of instability.[1] Qualitatively speaking, the present bank stability within the project area is inadequate to resist large flood events and subsequent lateral migration of banks. Effects of sediment dynamics and bank stability as they relate to the floodplain are discussed in Section 3.5, Surface and Groundwater Resources.

3.4.3.2 Mitigation

Under the No Action Alternative, the current maintenance actions would continue, and other, specific mitigation practices would not be prescribed.

3.4.4 Environmental Consequences of Alternative B: Relocate Main Street Diversion

Relocating the Main Street Diversion to the vicinity of 200 East would affect the sediment deposition and erosion dynamics within the project area. This, in turn, would decrease the level of maintenance required to maintain channel capacity. The costs associated with channel maintenance are discussed in detail in Section 3.11, Socioeconomics and Environmental Justice.

Channel modification in the form of bank hardening also would affect the sediment dynamics within the project area, as it would alter the water flow dynamics and sediment input (see Section 3.5, Surface and Groundwater Resources, for more details). General trends in water velocity would affect the sediment deposition and erosion locations within the project area: decreases in water velocity would cause deposition, and increases in water velocity would cause erosion. The changes in longitudinal profile are included in the following discussion.

3.4.4.1 Direct and Indirect Effects

Channel improvements are needed to provide the capacity required to safely convey the 100-year flood. Needed improvements include removing channel constrictions and modifying the channel to be wider and deeper. Relocating the Main Street Diversion to the

1. The actual numerical instability has not been evaluated; therefore, no effect modifier will be used.

vicinity of 200 East and widening and deepening the channel approximately 2,000 feet upstream of the Main Street Diversion would decrease the amount of sediment currently deposited in the vicinity of the Main Street Bridge and the existing Main Street Diversion. Other needed improvements—including reconstructing the Woodbury Diversion to be wider, widening the channel 3,000 feet upstream of the Woodbury Diversion, and reducing the elevation drop below the diversion—would also decrease sediment deposition at this location, which would be a direct, major, beneficial effect in the long term. Under this alternative, some sediment deposition would occur upstream of the relocated diversion. However, with the exception of gravel-sized material that would be removed by the new relocated Main Street Diversion, much of the sediment would remain with the diverted water. Some of this suspended material would be either removed with a settling pond or sluiced back into the channel to be carried through the system west of I-15. The remaining suspended sediment would continue with the diverted water through the irrigation system and would eventually be deposited in agricultural fields, where the water would be used for irrigation.

This alternative would necessitate the removal of the Coal Creek Bridge west and downstream of the Woodbury Diversion. This would result is some short-term risk of sedimentation until the streambanks are hardened. However, the long-term alterations in this area would ultimately result in greater channel stability and less potential for erosion.

Under this alternative, erosion control in the form of bank hardening would occur as necessary from 200 East up to the UP&L drop structure in Cedar Canyon. The channel modifications would increase the velocity of water flowing through the hydraulically-restricted areas presently within the project reach, thus increasing direct, major, beneficial effects within the project area. Erosion control in the upper reaches of Coal Creek would have minor, beneficial effects on both the project area and downstream users by increasing channel stability and decreasing downstream sedimentation.

Access to the channel for bank hardening activities, levee construction, and channel modification to reduce the FEMA floodplain width would result in some short-term soil disturbance, increasing the chances of water and wind erosion in those areas. The footprint for channel modifications in Alternative B, including levee construction and bank stabilization, totals 18.03 acres, with 16.03 acres of this disturbance occurring in highly water-erodible soils. Additionally, this footprint would affect 2.36 acres of moderately wind-erodible soils. Approximately 0.75 acres of gypsiferous soils are located within this footprint, but these soils would not be at risk for subsidence.

Parkway construction would also result in soil disturbance and potential for soil wind and water erosion. The proposed parkway footprint for Alternative B would be approximately 6.38 acres under Parkway Option B1 and 6.50 acres under Parkway Option B2. Soils susceptible to water erosion total 5.33 acres under Parkway Option B1 and 5.45 acres under Parkway Option B2. Additionally, gypsiferous soil disturbance totals 0.09 acres under both parkway options (Soil Mapping Unit 310), and excessive irrigation of these gypsiferous soils to establish parkway vegetation could result in some ground subsidence. However, it should be noted that subsidence would be minimal, considering this is a relatively small amount of impacted soil.

Short-term impacts to soil resources under this alternative would be greater than those experienced under the No Action Alternative. However, these short-term soil disturbance impacts are relatively small and could be mitigated via adherence to BMPs. This alternative would also result in long-term benefits to soil resources through channel modifications, diversion improvements, and bank stabilization. This would increase long-term streambank stability and decrease annual erosion of soils in the stream channel during flood events.

3.4.4.2 Mitigation

The mitigation under Alternative B would consist of dredging the channel after high flow events. Sediment and debris would be removed from locations of buildup within the project area. The maintenance would be similar in kind to that under the No Action Alternative, but to a lesser degree.

Re-vegetating disturbed areas and utilizing BMPs would minimize the soil wind and water erosion described above. BMPs may include:

- Silt fencing to reduce stream sedimentation,
- Minimizing channel maintenance access points (thereby minimizing soil disturbance),
- Placing geo-fabric on disturbed soil surfaces for erosion control,
- Reseeding disturbed areas with turf grass or a native seed mix, and
- Implementing noxious weed control to ensure greater vegetative cover.

To reduce the potential for soil subsidence in gypsiferous soil types (i.e., Soil Mapping Unit 310), drip irrigation systems should be used to establish and maintain plantings along the parkway. Water application to the parkway should be consistent with levels of local precipitation in order to maintain the gypsiferous substrate.

3.4.5 Environmental Consequences of Alternative C: Replace Main Street Diversion

Channel modifications, bank stabilization, and replacing the Main Street Diversion would have impacts to soils and geology similar to Alternative B, though at slightly different levels of impacts on soils. These impacts are described in detail below.

3.4.5.1 Direct and Indirect Effects

As with Alternative B, channel improvements are needed to provide the capacity required to safely convey the 100-year flood. Needed improvements include removing channel constrictions, modifying the channel to be wider and deeper, and constructing a new diversion structure where the existing Main Street diversion structure is located. Constructing new diversion/drop structures where the existing Main Street and Woodbury diversion/drop structures are located would eliminate two significant channel constrictions and allow the longitudinal channel profile upstream of these structures to be dropped. This, in turn, would have direct, major, beneficial effects by allowing sediment to move through the channel, partially alleviating sedimentations in the channel upstream of these structures.

Some sediment deposition would likely continue to occur upstream of the new Main Street and Woodbury structures; however, with the exception of gravel-sized material that would be removed by the reconstructed diversion/drop structures, much of the sediment would remain with the diverted water. Some of this suspended material would be either removed with a settling pond or sluiced back into the channel to be carried through the system west of I-15. The remaining suspended sediment would continue with the diverted water through the irrigation system and would eventually be deposited in agricultural fields, where the water would be used for irrigation.

This alternative would necessitate the removal of the Coal Creek Bridge west and downstream of the Woodbury Diversion. This would result is some short-term risk of sedimentation until the streambanks are hardened. However, the long-term alterations in this area would ultimately result in greater channel stability and less potential for erosion.

As with Alternative B, this alternative would implement erosion control in the form of bank hardening, which would occur as necessary from 200 East up to the UP&L drop structure in Cedar Canyon. The channel modifications would increase the velocity of water flowing through the restricted areas presently within the project reach, thus increasing direct, major, beneficial effects within the project area. Erosion control in the upper reaches of Coal Creek would have minor, beneficial effects on both the project area and downstream users by increasing channel stability and decreasing downstream sedimentation.

Access to the channel for bank hardening activities, levee construction, and channel modification to reduce the FEMA floodplain width would result in some short-term soil disturbance, increasing the chances of water and wind erosion in those areas. The disturbance footprint for channel modifications in Alternative C, including levee construction and bank stabilization, totals 18.47 acres, with 16.46 acres of this disturbance occurring in highly water-erodible soils. Additionally, this footprint includes 6.16 acres of moderately wind-erodible soils. Approximately 0.97 acres of gypsiferous soils are also located within this footprint, but these soils would not be at risk for subsidence.

The North Field Canal option would increase the disturbance footprint for Alternative C to 19.80 total acres, with 17.79 acres of this disturbance occurring in highly water-erodible soils. In addition, this modified footprint would include 6.95 acres of moderately wind-erodible soils. Approximately 1.75 acres of gypsiferous soils are also located within this footprint.

Parkway construction would also result in soil disturbance and potential for soil wind and water erosion. The proposed parkway footprint for Alternative C (including Parkway Options C1 and C2) would be 6.44 acres. Soils susceptible to water erosion total 5.39 acres. Impacted gypsiferous soil acreage totals 0.19 acres, and excessive irrigation of gypsiferous soils to establish parkway vegetation could result in some ground subsidence. However, subsidence would be minimal, considering this is a relatively small amount of impacted soil.

Accordingly, impacts to soil resources would be larger than Alternative A, and slightly greater than those experienced under Alternative B. However, similar to Alternative B, these impacts would be short-term and could be mitigated via adherence to BMPs. This alternative would also have long-term benefits to soil resources, in the form of increased streambank stability and decreased erosion of soils in the stream channel during flood events.

The longitudinal profile under Alternative C would not change significantly from the profile under Alternative B; therefore, direct and indirect effects would be the same as Alternative B. The cross sections under Alternative C would be the same as they would be under Alternative B (see Figure 2.2).

3.4.5.2 Mitigation

Mitigation measures for Alternative C are similar to those discussed for Alternative B.

3.5 Surface and Groundwater Resources

Coal Creek is located within the Cedar/Beaver Basin, which in turn is part of the larger Sevier River Basin. Elevations within the Sevier River Basin range from 4,600 feet to 12,173 feet above mean sea level. Waters in the basin drain into the Sevier River and terminate in the Sevier Lake playa, which is normally dry. Only during extremely wet water years or periods of intense precipitation is there surface water outflow from the basin. Early spring warming results in runoff that occurs too early for irrigation use due to lack of storage within the Coal Creek watershed; water flows into the western valley and Quichapa Lake, a terminal lake fed primarily by diversion of a portion of Coal Creek. Much of this valley water evaporates; however, a portion seeps into the ground through gravel deposits located along the course of the creek to recharge the valley aquifer. This subsurface flow (contributing an estimated 40,000 acre-feet annually), together with that resulting from agricultural irrigation, represents the primary source of recharge to the aquifer (personal communication with L. Brooks, UGS, April 2005; UDEQ 2000).

A recent hydrogeological study by USGS (1998) found that groundwater in Cedar Valley is present under confined, unconfined, and perched conditions. The valley-fill aquifer is composed primarily of highly permeable beds of sand and gravel that yield up to 4,000 gal/min (15,100 L/min) of water, as well as layers of clay and silt (Eisinger 1998).

Coal Creek is the largest perennial stream in the Cedar Valley drainage basin, with an average annual discharge of 23,830 acre-feet, and provides nearly all the surface water used in Cedar Valley (Eisinger 1998). Surface water runoff is primarily the result of snowmelt, which occurs in April, May, and June. Additional surface water runoff and groundwater recharge are observed during the intense, short-duration thunderstorms common in the summer months and, to a lesser extent, in the spring and fall.

Average channel velocities during the 100-year cloudburst storm in the 6 identified sub-reaches of the project area have been estimated from the hydraulic model created for this project. Table 3.8 summarizes the average channel velocities through each reach of the study area during a 100-year cloudburst flood.

Table 3.8. Average channel velocities by Sub-reach

Sub-Reach	Average Velocity (fps)
A	12.0
B	12.0
C	10.6
D	10.8
E	10.6
F	7.7

These high flow velocities make it clear that some type of reliable channel armoring would be required to stabilize the channel, particularly the channel banks.

3.5.1 Existing Conditions

3.5.1.1 Water Use

The primary use of water in the Coal Creek drainage is irrigation (agricultural and residential/municipal), with approximately 44,000 acre-feet utilized on an annual basis (42% from surface water and 58% from groundwater supplies). Agricultural irrigation diversions are present on every river and stream in the Cedar Valley area. Perennial streams are the major source of groundwater recharge in the valley, and withdrawal of water from wells is the single largest means of groundwater discharge. Groundwater levels range from near the ground surface in the central portion of the valley to approximately 250 feet below the surface along the valley margins (Eisinger 1998).

Although surface waters in the area were used historically for culinary water supplies, wells and springs (piped) are now used, almost exclusively. Most of the culinary water for Cedar City comes from seven wells that have recently experienced a decline in groundwater level (UDEQ 2000). Nitrate-enriched groundwater below Cedar City is being considered as a source for secondary water (UDWR 2005). The high nitrate water would be suitable for sprinkler irrigation and could be used on large landscapes (UDEQ 2000). To reduce the potential that this nitrate-enriched water would migrate into areas of the aquifer currently being used as a drinking water source, piping would be the preferred method of delivery.

3.5.1.2 Water Quality

A discussion of existing water quality conditions is included here as a baseline for the assessment of projected effects from the Proposed Action and alternatives.

3.5.1.2.1 Surface Water Quality

The UDEQ and USGS conducted water chemistry monitoring programs near the USGS gage site on Coal Creek from 1980 through 1997 (EPA 2005c). Water quality parameters collected include alkalinity, total dissolved solids (TDS), specific conductance, total suspended solids (TSS), turbidity, dissolved oxygen (DO), pH, and water temperature and flow. As there were no data available downstream of this study site, the available data were assumed to be representative of water quality within the project area in general trend and relative concentration. The State of Utah has identified the designated beneficial uses for Coal Creek as:

- secondary contact recreation;
- cold water species of game fish and other cold water aquatic life, including the necessary aquatic organisms in their food chain; and
- agricultural water supply including irrigation of crops and stock watering (Utah State Code R317-2-13.6a).

Water quality standards for DO, water temperature, pH, turbidity, and TDS, specific to the support and protection of these designated uses, have been identified by the state as contained in Tables 2.14.1 and 2.14.2 of the Utah State Code R317-2-13 (March 2005). With the exception of pH and water temperature, the available data show no exceedances of the identified criteria.

Exceedances of the pH criteria (pH less than 6.5 or greater than 9.0) occurred approximately 1% of the time in the available dataset (i.e., one data point) and were not indicative of beneficial use impairment.

Exceedances of the water temperature criteria (no greater than 20°C) occurred approximately 6% of the time in the available dataset (i.e., six data points, all observed during summer months).

A seasonal assessment of the applicable water quality data showed that alkalinity remained relatively constant over the course of a year and, therefore, likely was not flow-dependant to a high degree. TDS and specific conductance were observed to decrease during high-volume spring flows (Figure 3.5). The change in concentration in TDS and specific conductance during peak flows indicates that at least a portion of these constituents is the result of downstream enrichment, rather than headwater- or upper basin-specific.

A similar assessment of DO, pH, and water temperature (Figure 3.6) showed that pH remained relatively constant over the course of a year and, therefore, likely was not flow-dependant to a high degree. A slight decline in DO was observed to occur through the summer season and exhibited timing similar to that observed for elevated water temperatures. No exceedances of the DO criteria were recorded. Water temperature was observed to exceed its criteria (no greater than 20°C) periodically during summer months. Both DO and water temperature are undoubtedly influenced to some degree by high, summertime air temperatures and solar radiance in the watershed.

While a portion of the soils in the project area have been characterized as having little to no risk of water-induced erosion (see Section 3.4), the majority of the soils (approximately 87%) have a high erosion potential. As is evidenced by the measured sediment and solids concentrations measured in Coal Creek, this high erosion potential exists throughout the watershed in general, not just within the project area boundaries.

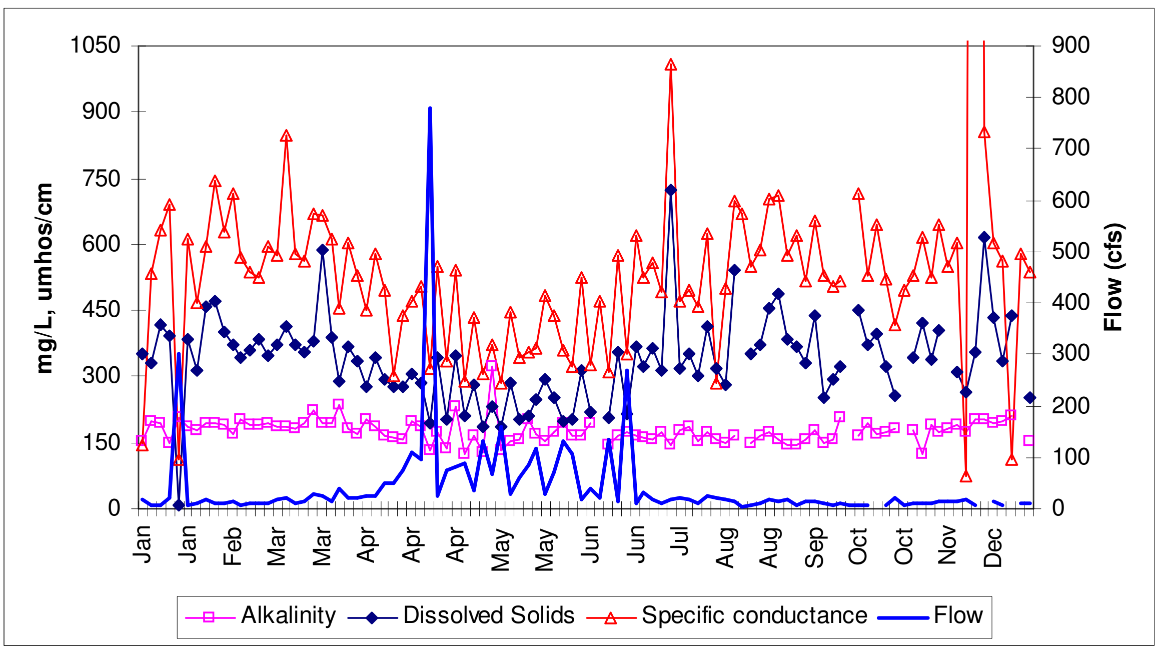

Figure 3.5. Seasonal variation in alkalinity, total dissolved solids (TDS), and specific conductance compared to flow observed in Coal Creek at the canyon mouth (1980 to 1997). NOTE: A single specific conductance of 5,730 µmhos/cm (November) was not displayed in this plot due to scale considerations. Source: EPA 2005c.

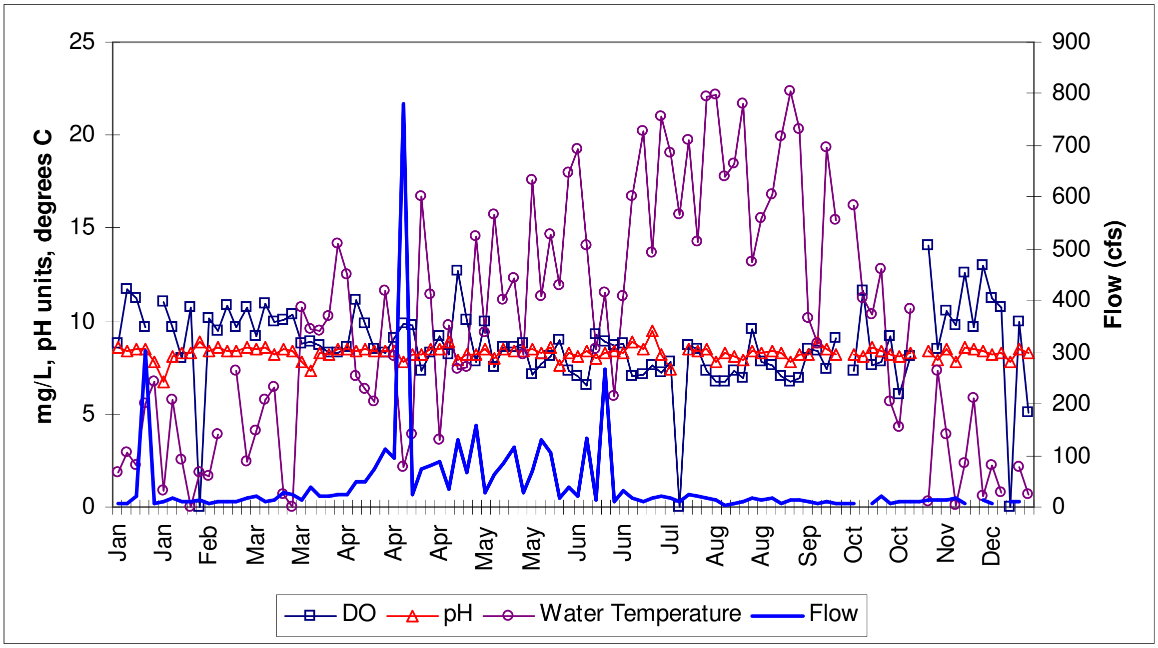

Figure 3.6. Seasonal variation in dissolved oxygen (DO), pH, and water temperature compared to flow observed in Coal Creek at the canyon mouth (1980 to 1997). Source: EPA 2005c.

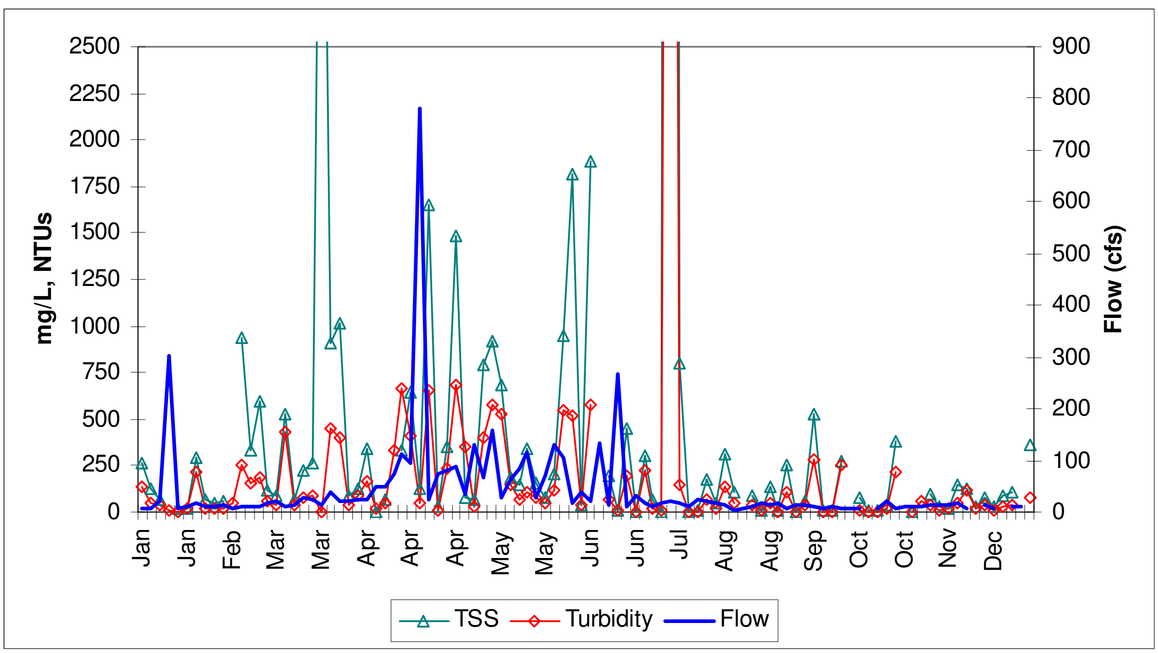

Figure 3.7. Seasonal variation in total suspended solids (TSS) and turbidity compared to flow observed in Coal Creek at the canyon mouth (1980 to 1997). NOTE: TSS concentrations of 5,120 mg/L (March) and 31,930 mg/L (July) and a single turbidity of 12,378 NTU (July) were not displayed in this plot due to scale considerations. Source: EPA 2005c

TSS concentrations and turbidity (Figure 3.7) were observed to increase during periods of high flow, indicating that at least a portion of these constituents is the result of upstream enrichment, most likely related to erosive processes in the upper watershed. Coal Creek has been observed to transport more sediment than any other stream in the basin. Low-flow sediment concentrations range from 200 to 500 mg/L, while flood-flow concentrations are frequently much higher. A single flood event in Coal Creek measured at 1,200 cfs was observed to have a TSS concentration of nearly 700,000 mg/L, which equates to a sediment yield of 2.3 million tons per day. For comparison, high flows in the Beaver River were observed to yield TSS concentrations of approximately 1,200 mg/L. Average, low-flow sediment loading in Coal Creek is estimated at 6 tons per day, and high flow sediment loading is estimated at 352 tons per day (EPA 2005c).

The extended drought, high snow pack, elevated soil moisture content, and heavy rains in the late winter and spring months of 2005 caused some flooding in new residential areas to the southwest of the city and increased deposition in the channel. Earlier this year (2005), it was estimated that the channel under I-15 (originally 15–20 feet below the bridges) was silted in to within 3 feet of the bottom of the bridges (UDEQ 2000). This change in depth is a firm indication of substantial, in-channel sedimentation.

While TSS concentrations have been observed to be increasing slightly in recent years, Coal Creek has been recorded as being an active transporter of sediment since the first white settlers entered the Cedar Valley. Historical records report that the creek flooded frequently, washing away diversion dams and inundating newly developed iron processing operations. The water level in the creek fluctuated dramatically both seasonably and with unpredictable flash floods. The first settlers initially named the creek the "Little Muddy" as descriptive of the high sediment loading (UHE 2005).

Runoff-producing events (e.g., storms) within the Coal Creek watershed still result in muddy waters, the color of which can indicate the location of the downpour. Rains in the upper watershed near Cedar Breaks result in the transport of red-colored mud, while rains nearer the mouth of Cedar Canyon produce brown mud (UDEQ 2000). This correlation with stream-channel sediments substantiates the conclusion that a good portion of the existing sediment load in the creek is the result of erosive processes in the upper watershed.

The State of Utah has not identified a water quality criterion for TSS. Turbidity criteria are generally applied to permitted discharges only and therefore do not routinely apply to surface water conditions. However, the observed, very high magnitude of these constituents, well above that observed in other water bodies in the drainage, is an indication that care should be taken to minimize any increases in these parameters.

3.5.1.2.2 Groundwater Quality

A recent survey of groundwater quality by USGS (1998) stated that recent groundwater data collected by the Utah Division of Water Resources (UDWaR), the UDEQ, and the USGS indicate the presence of high TDS and nitrate concentrations in some wells.

TDS concentrations in Cedar Valley groundwater were observed to vary between 158 and 2,752 mg/L. The most probable source of these concentrations is the rocks through which the water flows, which contain significant quantities of sodium and calcium. While groundwater in the valley is generally suitable for most uses, it was noted that the "concentration of dissolved solids tends to increase with time in areas where large quantities of water are pumped for irrigation" (Eisinger 1998: 9).

Nitrate is the principal groundwater contaminant identified in the Cedar Valley basin-fill aquifer (Eisinger 1998). Available concentration data range from less than 0.06 mg/L to 57.40 mg/L. Wells with elevated nitrate concentrations were observed to be distributed throughout the valley, although high-nitrate wells are more common near the Hurricane fault on the east side of the valley (Eisinger 1998). Culinary water for Cedar City comes from wells that meet state criteria of no greater than 10 mg/L nitrate, but water from higher-nitrate wells under the city is being considered for secondary uses like irrigation (UDWR 2005). Potential sources of the nitrates include sewage lagoons, septic tank soil-absorption systems, and agricultural fertilizer.

3.5.2 INDICATORS

Short-term indicators of the affected environment specific to water quality include:

- changes in TSS concentration and turbidity;
- changes in water temperature due to removal of vegetation and construction-related (temporary) diversion; and
- changes in alkalinity, TDS, and specific conductance related to flow.

Indicators of long-term effects—specific to bank stabilization, re-sloping, and revegetation activities common to both action alternatives—are changes in TSS and turbidity.

The following sections analyze the potential effects of the Proposed Action and alternatives on water quality within and downstream of the project area.

3.5.3 ENVIRONMENTAL CONSEQUENCES OF ALTERNATIVE A: NO ACTION

The No Action Alternative includes continued dredging in the Coal Creek channel, when and where necessary. Additional erosion control and streambank hardening activities may be conducted as required under this alternative; however, no additional on-site construction is currently planned. No additional parkway improvements would be conducted under this alternative. Proper installation and maintenance of appropriate stormwater and sediment control BMPs are assumed for all activities under this alternative.

3.5.3.1 Direct and Indirect Effects

Direct effects on surface water quality from implementation of the No Action Alternative within and downstream of the project area could be substantial. Direct, adverse effects on surface water quality include elevated suspended sediment and turbidity generated from soil disturbance, in the case of channel dredging (minor, short-term), and erosion resulting from extreme flood and flow events (major, short- and long-term). Existing data on flood-borne sediment loading shows that even short-duration flooding or high-flow events can generate very large sediment loads from destabilized banks upstream of and within the project area.

Indirect, adverse effects include an increased potential for short-term generation of suspended sediment and turbidity due to the removal of existing bank and upland vegetation and subsequent erosion caused by extreme flow events. For both direct and indirect effects, adverse effects on water quality within the Coal Creek drainage could be substantial.

Due to the relative isolation of the Coal Creek drainage, sediment transport to areas or waterbodies outside the immediate basin is unlikely and is not projected to occur in any appreciable fashion under this alternative.

No appreciable direct or indirect effects on groundwater quality are projected to occur under this alternative.

3.5.3.2 Mitigation

Mitigation measures should include scheduling dredging activities at periods of low flow whenever possible, appropriate storage or off-site removal of dredged material to minimize the potential for re-entrainment during storm events, and timely reseeding/revegetation of the affected locations in the project area following major flooding events.

3.5.4 Environmental Consequences of Alternative B: Relocate Main Street Diversion

Alternative B proposes the removal and relocation of the Main Street Diversion to near 200 East. Implementation of this alternative would require the installation of approximately 3,250 feet of pipeline, flood- and slope/grading-related channel modifications from subreaches B to E (Center Street to I-15), and the continuation of periodic dredging as necessary. Under this alternative, the parkway would be extended to Airport Road, on both sides of the river where possible, and landscaped/vegetated. Proper installation and maintenance of appropriate stormwater and sediment control BMPs are assumed for all activities under this alternative.

3.5.4.1 Direct and Indirect Effects

Direct and indirect effects on surface water quality from the implementation of Alternative B include short-term, adverse effects and long-term benefits.

3.5.4.1.1 SHORT-TERM EFFECTS

Short-term, adverse effects are projected to include:

- increased suspended concentrations and elevated turbidity within and downstream of the project area;
- increased water temperature due to removal of vegetation and construction-related (temporary) diversion; and
- increased TDS and specific conductance due to reduced flow and increased temperatures during construction and revegetation.

Temporary increases in sediment loading caused by construction-related activities in or near the flowing channel would be specific to soil/sediment removal and/or placement, bank and channel stabilization activities, and equipment access-ways. Increases in sediment loading from construction-related activities on the uplands within the project area would be specific to soil/sediment storage, stabilization procedures, and precipitation events occurring during the construction period. The magnitude of increase would depend on the construction and management practices employed, the construction-related diversion techniques used, the magnitude and frequency of diversions required, and the duration of activity in the channel. If appropriate sediment BMPs are assumed for all in-channel and upland construction activities, these increases are expected to be temporary and negligible in comparison to the flood- and extreme event-driven increases projected to occur under the No Action Alternative.

Construction-related activities under this alternative have the potential to result in short-term increases in water temperature due to vegetation removal, channel widening and re-sloping, and diversion of water around the immediate construction area. As with sediment- and turbidity-related effects, water temperature effects would depend on the construction practices employed, the construction-related diversion techniques used, and the magnitude, frequency, and duration of water diversion. Removal of streamside vegetation would reduce the area and density of available shade and increase the potential for solar heating, resulting in incremental increases in water temperature. Channel widening and/or reshaping may result in a permanent, wider exposure profile (view-to-sky) to solar radiation and a reduction in in-channel shading, both of which would result in incremental increases in water temperature. If vegetation removal is minimized, revegetation is undertaken in a timely fashion, and productive growth is realized, the overall effects on water quality from these activities are projected to be minor and short-term.

The seasonal assessment of water quality data discussed previously showed that TDS and specific conductance were sensitive to flow volume, increasing in concentration during periods of low flow, most often due to instream enrichment. An increase in the concentration of these constituents following in-channel activities specific to this alternative is possible due to a number of factors. Elevated water temperatures allow soluble constituents within the sediments and soils to dissolve to higher concentrations in the water column and decrease the time required for dissolution to occur. In addition, diverted waters tend to flow over soils and sediments that have not been in routine contact with water previously. These sediments generally have not been depleted of soluble constituents to the same degree that bed sediments have; hence, there is more available to dissolve. Diverted water also often moves more slowly than the in-channel flows due to debris and rough materials in the diversion path and increased channel meanders. Finally, because diversions generally require going *around* the existing flow path to allow construction access and activity, the overall flow path for diverted water is greater than the in-channel distance (i.e., the path of least resistance); therefore, the diverted water is exposed to more soil/sediment (greater surface area) than if it had remained in the original, more direct channel.

The combination of increased water temperatures and diversion path effects would allow the diverted water to dissolve more soluble constituents than in the original channel, resulting in higher water column concentrations within and downstream of the construction area. The magnitude of the projected effect would depend primarily on the construction practices employed, the construction-related diversion techniques used, and the magnitude, frequency, and duration of water diversion. If diversion frequency, duration, and distance are minimized, the overall effects on water quality from diversion-related activities would likely be short-term and are not projected to result in water quality violations of TDS. Water quality criteria for specific conductivity have not been identified by the State of Utah.

3.5.4.1.2 Long-term Effects

Long-term effects from the implementation of Alternative B are projected to include:

- seasonal dewatering of an additional 1,600 of the Coal Creek channel downstream of the relocated diversion structure (sub-reach C) due to the need to divert irrigation water;
- decreased suspended concentrations and turbidity within and downstream of the project area due to reduced in-channel erosion;
- similar or decreased water temperatures due to planned, consistent revegetation activities; and
- decreased TDS and specific conductance due to reduced in-channel erosion.

Seasonal dewatering of Coal Creek channel occurs currently as water is diverted at the existing Main Street Diversion for irrigation use. This alternative would not impact any existing water rights. It would, however, move the point of diversion upstream approximately 1,600 feet, effectively dewatering that reach of the creek channel during much of the irrigation season.

Long-term reductions in suspended sediment loading, deposition and turbidity are projected to be substantial. While TSS concentrations and turbidity were observed to be in part the result of erosive processes in the upper watershed (not affected by the Proposed Action), a portion of the total loading is specific to erosive processes occurring within the project area. Reducing this additional loading would result in less sediment transport, increased water clarity, and reduced deposition in restricted areas of the channel (like bridge locations).

Reduced deposition would in turn reduce the frequency at which dredging is necessary, representing less overall impact on the immediate channel. In addition, the suspended load of diverted irrigation water would be reduced, as the sedimentation basin would remove much of the gravel from the water. This would decrease the amount of channel maintenance over time.

Erosion, similar to diversion, allows water to flow over soils and sediments that have not been in routine contact with water previously, either via bank sloughing or channel meander. These "new" sediments contain higher concentrations of soluble constituents than the established bed material and, thus, act to increase the water column concentration of soluble constituents. A reduction in erosion-based deposition and erosion-caused channel alteration would result in reduction in these constituents, thereby improving water quality.

Due to the relative isolation of the Coal Creek drainage, sediment transport to areas or waterbodies outside the immediate basin is unlikely and is not projected to occur in any appreciable fashion under this alternative.

Since most aquifer recharge occurs downstream of the project corridor, no adverse effects on chemical groundwater quality are projected under this alternative.

Post-construction, diverted waters are expected to experience a site-specific reduction in temperature due to piping; however, as temperature is not a conservative constituent and much of the irrigated area is open and exhibits only low growth, water temperatures are expected to increase to equilibrium with the air soon after exiting the pipe. Therefore, no consistent, long-term temperature effect is projected to occur as a result of piping.

3.5.4.2 Mitigation

To mitigate dewatering of the 1,600-foot reach of the creek below the relocated diversion structure, it may be possible to maintain a minimum flow (1-2 cfs) in the channel. The City may accomplish this through the purchase of existing water rights, or negotiating the voluntary turning down of water by the City or other water rights holders. This mitigation is not analyzed in this document as part of the alternative, but is mentioned here as a possible measure that the City may want to explore in the future.

Water temperature and TDS constituent mitigation measures should include timely and effective revegetation and stabilization of denuded areas and resloped channel walls, as well as minimization or limitation of construction-related diversion frequency, distance, and duration.

Sediment loading and turbidity mitigation measures should include scheduling dredging activities at periods of low flow whenever possible, appropriate storage of dredged material to minimize the potential for re-entrainment during storm events, and timely reseeding/revegetation of the affected locations in the project area following major flooding events.

3.5.5 Environmental Consequences of Alternative C: Replace Main Street Diversion

Alternative C proposes to construct a new diversion/drop structure where the existing Main Street Diversion is located. The new structure would have an approximate bottom width of 50 feet and a new channel invert approximately 4 feet lower than the existing invert. Implementation of this alternative would require installation of up to 3,000 feet of pipeline, flood- and slope/grading-related channel modifications in sub-reaches B through E (from Center Street to west of I-15), and the continuation of periodic dredging as necessary. Under this alternative, the parkway would be extended to Airport Road on both sides of the river and landscaped/vegetated. Proper installation and maintenance of appropriate stormwater and sediment control BMPs are assumed for all activities under this alternative. The North Field Canal option would use one pipe instead of three pipes to convey water from the sediment basin to the existing irrigation system.

3.5.5.1 Direct and Indirect Effects

Unlike Alternative B, this alternative would not dewater any additional length of the creek channel. Because the diversion structure would remain in the same location, there would be no change in water flow from current conditions. However, other direct and indirect effects on water quality resulting from replacing the Main Street Diversion and channel would be similar to Alternative B, even though a greater length of pipeline would be installed. Similar to Alternative B, the water quality of diverted irrigation water would increase due to the removal of gravels in the sedimentation basins.

Additional soil disturbance would occur under this alternative relative to Alternative B (1.33 acres); however, given appropriate soil stabilization and revegetation measures specific to the additional pipe installation proposed, the effects of modifying the Main Street Diversion would be similar to those projected for Alternative B. Piping the North Field Canal as an option under Alternative C would result in slightly greater, but similar effects to those projected for Alternative B.

Due to the relative isolation of the Coal Creek drainage, sediment transport to areas or waterbodies outside the immediate basin is unlikely and is not projected to occur in any appreciable fashion under this alternative. In addition, the suspended load of diverted irrigation water would be reduced as sedimentation basins would remove much of the gravel from the water. This would decrease the amount of channel maintenance over time.

Since most aquifer recharge occurs downstream of the project corridor, no adverse effects on chemical groundwater quality are projected under this alternative.

The North Field Canal option would reduce localized flooding in the vicinity of 1045 North.

3.5.5.2 Mitigation

Other than the possible use of a minimum maintenance flow in the channel, the mitigation measures for Alternative C are similar to those discussed for Alternative B.

3.6 Vegetation Resources

The plant species in the project area directly determine the type and quality of habitat available for wildlife species. Additionally, vegetation can have indirect impacts on air quality, surface water and groundwater resources, geology and soils, recreation and visual resources, and socioeconomic resources.

- Vegetation plays an important role in improving air quality in and around urban areas. In addition to providing oxygen, trees and other vegetation act as air filters, taking up pollutants from the air (Fowler 2002). A detailed discussion of air quality resources is located in Section 3.3.
- When vegetation is removed from an area, severe erosion and stream sedimentation can result. Over time, human use of Cedar Canyon, including livestock grazing, timber harvesting, coal mining, and road building, has changed the natural characteristics of the Coal Creek watershed. The loss of vegetative cover via grazing and timber harvest contributes to local erosion. A detailed discussion of geology and soil resources is located in Section 3.4.
- Groundwater resources can be affected by the type and amount of vegetation in the project area. Plant species such as tamarisk and Russian olive draw down the water table more than native cottonwood and willows (USGS 2000). Furthermore, the course of surface water flow can be altered by the presence/absence and distribution of vegetation in an area. A detailed discussion of surface water and groundwater resources is located in Section 3.5.
- Wetlands, riparian areas, and wildlife resources are also affected by the amount and types of vegetation present in an area. Both wetland and riparian areas are defined by the types of vegetation they contain. Wildlife habitat consists of specific types of vegetation for food and shelter of native animal species. A detailed discussion of wetlands and riparian resources is located in Section 3.7, and a discussion of wildlife resources is located in Section 3.8.
- Tourists and other visitors are drawn to Cedar City and the surrounding area in part because of the natural features, including vegetation. Therefore, recreation, visual, and socioeconomic resources have the potential to be affected by the vegetation of the project area. A detailed discussion of recreation and visual resources is located in Section 3.10, and a discussion of socioeconomic resources is located in Section 3.11.

3.6.1 Existing Conditions

This section describes the existing, baseline condition of the vegetation within the project area. A site visit was conducted in April 2005 to catalog plant species present in the project area. The vegetation associations within the Coal Creek project area were then classified using vegetation communities defined below.

Within the project area, vegetation communities observed include:

- Disturbed sagebrush/perennial grass
- Mountain shrub
- Undesirable plant species and noxious weeds
- Riparian areas and wetlands

Descriptions of disturbed sagebrush/perennial grass, mountain shrub, and undesirable and noxious weed plant communities, as well as general locations of these communities within the project area, are provided below. Riparian and wetland vegetation communities and locations are discussed in Section 3.7.

3.6.1.1 Disturbed Sagebrush/Perennial Grass

This community, commonly found in urban environments, is located primarily in sub-reaches C-F (200 East Bridge to Airport Road) of the current project area (Figure 3.8). This plant community includes sparse shrubs and weedy species such as cheatgrass, flixweed, and curve seed butterwort (Table 3.9).

3.6.1.2 Mountain Shrub

The mountain shrub community is primarily located in sub-reaches A and B (UP&L drop structure to 200 East Bridge) of the project area (Figure 3.8). This association is sometimes called browse, because a large proportion of the species in this association are of high forage and cover value for wildlife (Table 3.10). The sagebrush may occasionally grow densely in areas, but generally, it is less than 50% of the overall composition in this community. Many forbs also occur in this area and are an important resource for sage grouse (Edwards et al. 1994).

3.6.1.3 Riparian and Wetland Species

Common plant species in this association are shown in Table 3.11. Further discussion of wetland and riparian areas is in Section 3.7.

Figure 3.8. General location of plant communities within the project area.

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Table 3.9. Common Species Observed in the Disturbed Sagebrush/Perennial Grass Community

Scientific Name	Common Name
Shrubs	
Artemisia tridentata spp. *tridentata*	Basin big sagebrush
Chrysothamnus viscidiflorus	Yellow rabbitbrush
Grasses and Forbs	
Bromus tectorum	Cheatgrass
Carduus nutans	Musk thistle
Ceratocephala testiculata	Curve seed butterwort
Chorispora tenella	Blue mustard
Descurania sophia	Flixweed
Elymus repens	Quackgrass
Erodium cicutarium	Redstem stork's bill
Salsola tragus	Prickly Russian thistle

Plant names are from the NRCS Plants Database 2005.

Table 3.10. Common Species Observed in the Mountain Shrub Community

Scientific Name	Common Name
Trees	
Juniperus osteosperma	Utah juniper
Pinus edulis	Two needle pinyon
Shrubs	
Amelanchier utahensis	Utah serviceberry
Artemisia tridentata spp. *tridentata*	Basin big sagebrush
Atriplex canesens	Four-wing saltbush
Cercocarpus ledifolius	Curly leaf mountain mahogany
Chrysothamnus viscidiflorus	Yellow rabbitbrush
Fallugia paradoxa	Apache plume
Fraxinus anomala	Singleleaf ash
Purshia tridentata	Bitterbrush
Grasses and Forbs	
Achnatherum hymenoides	Indian ricegrass
Chorispora tenella	Blue mustard

Table 3.10. Common Species Observed in the Mountain Shrub Community, continued

Scientific Name	Common Name
Elymus canadensis	Wild rye
Gutierrezia sarothrae	Broom snakeweed
Hesperostipa comata	Needle and thread grass
Hordeum leporinum	Hare barley
Leptodactylon pungens	Shrubby phlox
Pascopyrum smithii	Western wheatgrass
Pseudoroegneria spicata	Bluebunch wheatgrass
Yucca filamentosa	Yucca

Plant names are from the NRCS Plants Database 2005.

Table 3.11. Common Species Observed in the Riparian and Wetland Communities

Scientific Name	Common Name
Trees	
Populus fremontii	Fremont Poplar
Salix exigua	Narrowleaf Willow
Populus angustifolia	Narrowleaf cottonwood
Elaeagnus angustifolia	Russian olive
Shrubs	
Cercocarpus montanus	Alderleaf mountain mahogany
Artemisia tridentata ssp. *tridentata*	Basin big sagebrush
Grasses and Forbs	
Phalaris arundinacea	Reed canarygrass
Equisetum laevigatum	Smooth horsetail
Juncus balticus	Black-tip needle rush

Plant names are from the NRCS Plants Database 2005.

3.6.1.4 Undesired Plant Species and Noxious Weeds

OHV and other vehicle use, construction activities, soil disturbance, wildlife movement, and domestic livestock grazing activities can each increase the spread and establishment of noxious weeds and undesired plant species. The vegetation in sub-reaches C-F (200 East Bridge to Airport Road) of the project area consists largely of undesirable plant species and/ or noxious weeds, with very few, if any, native species (see Figure 3.8).

For management purposes, noxious weeds are identified and recognized by the federal government, the state, and local counties. Utah state noxious weeds known in Iron County include musk thistle, Canada thistle, and whitetop. Other undesired plant species commonly found in the project area include cheatgrass and blue mustard. Common weedy plant species in this association are shown in Table 3.12.

Table 3.12. Common Undesired Plant Species and Noxious Weeds Observed in the Project Area

Scientific Name	Common Name	Status
Bromus tectorum	Cheatgrass	Colorado State Noxious Weed
Cardaria draba	Whitetop (hoary cress)	Utah State Noxious Weed
Carduus nutans	Musk thistle	Utah State Noxious Weed
Ceratocephala testiculata	Curve seed butterwort	Undesired Plant Species
Chorispora tenella	Blue mustard	Colorado State Noxious Weed
Cirsium arvense	Canada thistle	Utah State Noxious Weed
Descurania sophia	Flixweed	Colorado State Noxious Weed
Elaeagnus angustifolia	Russian olive	Carbon, Duchesne, Uintah, Sevier, and Wayne County Noxious Weeds
Euphorbia myrsinites	Myrtle spurge	Undesired Plant Species
Erodium cicutarium	Redstem stork's bill	Undesired Plant Species
Lepidium latifolium	Tall whitetop (perennial pepperweed)	Utah State Noxious Weed
Salsola tragus	Prickly Russian thistle	Undesired Plant Species

Plant names are from NRCS 2004.

3.6.2 Indicators

Indicators of the affected environment relating to vegetation include acres of vegetation types that serve as wildlife habitat or potentially suitable habitat, acres of bank-stabilizing vegetation, and acres of noxious weeds and introduced plant species present in the project area in the years following project completion. The following analysis includes the effects of changes in channel width, parkway construction, parkway vegetation installation, and construction associated with stream bed improvements upon type and extent of vegetative cover within the project area.

3.6.3 Environmental Consequences of Alternative A: No Action

The No Action Alternative includes continued dredging in the channel, when and where necessary. Minimal erosion control and streambank hardening would be conducted under the No Action Alternative. No parkway improvements would occur under this alternative.

3.6.3.1 Direct and Indirect Effects

The direct effects of the No Action Alternative on type and abundance of vegetation within the project area would be minimal under normal circumstances. However, in the case of a 100-year flood event, the existing channel and the current practice of dredging the channel under the Main Street Bridge would not be sufficient to confine the floodwaters within the streambanks. The flow of water out of the channel and across the existing floodplain could have direct and indirect, adverse effects on vegetation in the project area. Direct, adverse effects include removal of native vegetation along the Coal Creek stream corridor, which would mean a reduction in natural erosion control and mountain shrub and riparian vegetation in the project area. Other adverse effects would include an increased chance for invasion of noxious weeds and other undesirable plant species following the removal of existing, native vegetation. These invasions would then become seed sources for off-site infestations.

3.6.3.2 Mitigation

Mitigation measures should include reseeding sections of the project area with approved drought-tolerant, non-invasive native vegetation following major flooding events.

3.6.4 Environmental Consequences of Alternative B: Relocate Main Street Diversion

Alternative B involves relocating the Main Street Diversion to a site in the vicinity of 200 East. This would require construction of a sedimentation basin and the installation of approximately 3,250 feet of pipeline to transport water to a sedimentation basin and other irrigation facilities. This alternative would result in the dewatering of 1,600 feet of the existing Coal Creek channel starting at the proposed 200 East Diversion. This alternative would also include bank stabilization and levee construction in portions of the project area to provide for flood conveyance and restrict the FEMA 100-year floodplain to the channel itself. Under this alternative, periodic dredging would continue, when and where necessary. To facilitate channel maintenance, an access easement would be maintained along the channel throughout the project area.

Under Alternative B, the parkway currently located east of 200 East would be extended to Airport Road. It is assumed that the parkway would be landscaped with mostly native vegetation in sub-reaches A and B (from UP&L drop structure to 200 East Bridge) and with non-native vegetation in sub-reaches C-F (from 200 East Bridge to Airport Road).

3.6.4.1 Direct and Indirect Effects

Construction and earth-moving activities associated with the relocation of the Main Street Diversion, pipeline installation, maintenance road construction, and parkway construction could have direct and indirect, adverse effects on native vegetation in the project area.

Relocating the Main Street Diversion upstream to a site in the vicinity of 200 East and installing a new pipeline would have direct, adverse effects on the percent cover of vegetation in approximately 0.5 acres of sagebrush/perennial grass habitat in the project area.

The dewatering of the 1,600-foot reach between the location of the existing Main Street Diversion and the new location upstream would have little impact on the sagebrush/perennial grass community outside of the channel because of the low water requirements of existing species in that area. It would, however, likely result in mortality for any riparian species within the 1,600 feet of stream channel. Indirect, adverse effects include further invasion of noxious weeds and other undesirable plant species following the removal of existing vegetation. The sagebrush/perennial grass habitat and associated riparian habitat throughout the diversion relocation area has already been disturbed by the introduction of weeds during past construction projects in the area, so reseeding with native vegetation would be a priority in these areas.

Construction and earth-moving activities associated with erosion control modifications, channel widening, streambank modifications, and the construction of a new Woodbury diversion structure could have direct and indirect, adverse effects on approximately 13.2 acres of vegetation in the project area. Plants could be crushed, uprooted, or intentionally removed by earth-moving activities associated with streambank hardening and levee construction, which would mean a reduction in natural erosion control and wildlife habitat in the project area. Indirect, adverse effects include an increased chance for invasion of noxious weeds and other undesirable plant species in approximately 4.8 acres of relatively undisturbed mountain shrub habitat and associated riparian habitat, and 8.3 acres of already disturbed sagebrush/perennial grass habitat and associated riparian habitat.

Construction and earth-moving activities associated with maintenance road construction and use could have direct and indirect, adverse effects on approximately 4.2 acres of vegetation in all sub-reaches within the project area. The removal of native vegetation from 2.4 acres of sub-reach A (UP&L drop structure to Center Street Bridge) due to these activities would reduce mountain shrub habitat and increase the potential for invasion of noxious weeds and other undesirable plant species in the area.

Parkway construction and the planting of native and non-native vegetation in the project area could have direct and indirect, adverse and beneficial effects on existing vegetation. Direct, adverse effects include crushing, trampling, or removal of vegetation in approximately 5.7 acres of the project area, via earth-moving activities and parkway installation. Indirect, adverse effects include an increased chance for invasion of noxious weeds and other non-native plant species (including landscaping plants for the parkway) in all sub-reaches of the project area and a possible reduction in wildlife habitat in the project area.

Direct, beneficial effects would include planting native vegetation in sections of the project area that are currently disturbed and/or weedy. This could improve and expand the existing suitable and potentially suitable wildlife habitat. Indirect, beneficial effects include the exclusion of weedy vegetation from approximately 0.7 acres of the project area following landscaping with native vegetation.

3.6.4.2 MITIGATION

Mitigation measures should include the following:

- Reseed disturbed sections of the project area with native vegetation following project completion.
- Include as many drought-tolerant, non-invasive native species as possible in the landscaping of the existing and future parkway.
- Whenever possible, incorporate existing riparian vegetation into streambank hardening.
- Actively treat noxious weeds in disturbed areas.

3.6.5 ENVIRONMENTAL CONSEQUENCES OF ALTERNATIVE C: REPLACE MAIN STREET DIVERSION

Because replacing the Main Street Diversion would not cause the stream dewatering associated with Alternative B, it would have minimal effects on the riparian community within the stream channel. The construction of a new Main Street diversion structure would affect the same acreage of the sagebrush/perennial grass community as construction of the diversion structure proposed in Alternative B.

3.6.5.1 DIRECT AND INDIRECT EFFECTS

Direct and indirect effects of Alternative C would be the same as those outlined for Alternative B with the following exceptions. Under Alternative C, the areas of impact on vegetation would be slightly larger due to parkway construction (6.4 acres vs. 5.7 acres) and pipeline construction (0.6 acres vs. 0.5 acres) compared to Alternative B. The North Field Canal option would modify Alternative C impacts as follows: it would affect 0.6 less acres of disturbed sagebrush/perennial grass vegetation and 1.6 more acres of disturbed cover type. The North Field Canal option would also affect an additional 0.3 acres of riparian vegetation located along the existing canals. These impacts would result from direct impacts due to pipeline construction within the North Field Canal, as well as indirect impacts from removing water from the canal and putting it into the proposed pipeline. Both of these habitats are located within an urban environment and are subject to continued disturbance from foot and vehicle traffic, as well as noise disturbance from surrounding human activities.

The most substantial differences in vegetation impacts between Alternatives B and C is that any existing riparian vegetation that may occur along the 1,600 feet of streambed below the 200 East Diversion proposed by Alternative B would not be impacted under Alternative C.

3.6.5.2 Mitigation

Mitigation measures should be the same as those proposed for Alternative B.

3.7 Wetlands and Riparian Resources

This section of Chapter 3 discusses the wetlands and riparian resources located within the project area alternatives considered in this EIS, potential direct and indirect impacts to these resources, and mitigation measures that would eliminate or reduce adverse impacts to the wetlands and riparian resources.

Wetlands and riparian resources provide numerous ecological functions, particularly in arid climates. They can act as:

- filters (trapping sediment and debris),
- nutrient sinks or sources (taking up nitrogen and phosphorus from the water column while providing organic matter for energy for organisms),
- shade (decreasing water temperatures and providing habitat for fish),
- mechanisms for stabilizing banks and channels (decreasing stream flow and erosion),
- flood control (providing areas for high stream flows and associated energy to dissipate), and
- habitat and food sources for wildlife.

Wetlands are generally those areas that are inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support (and that under normal circumstances do support) a prevalence of vegetation typically adapted for life in saturated soil conditions. Swamps, marshes, and bogs generally meet this definition of wetlands, as do many riparian areas (Environmental Laboratory 1987). Riparian resources, often a subset of wetlands, are found along the banks of streams, rivers, ditches, and canals.

The areas delineated as wetlands in this EIS meet all three USACE criteria for a wetlands determination. The three criteria that must be met include:

1. the dominance of wetland plants (hydrophytes),
2. the presence of sufficient hydrology to support wetland plants and maintain hydric soils, and
3. the occurrence of hydric soils, which become established over a period of time through continuous wetting and drying cycles.

These wetlands are under USACE jurisdiction because they are adjacent to the Coal Creek, a waterway with ties to interstate or foreign commerce.

Appendix C contains the wetlands technical report prepared for this EIS.

3.7.1 EXISTING CONDITIONS

The project area was surveyed for wetlands and riparian resources on April 27 and 28, 2005, following the emergency dredging activities conducted in preparation for projected, high-snowmelt runoff. The project area is divided into three river reaches.

- The upper reach extends from the eastern boundary of the project area to just southeast of Center Street (sub-reach A), where the creek's banks begin to be more channelized and confined with rocks on either bank, thereby causing the creek to lose its ability to meander.
- The middle reach is that portion that extends from southeast of Center Street to a point approximately 200 feet west of the Main Street Bridge (sub-reaches B and C and the eastern portion of sub-reach D; see Figure 2.3).
- The lower reach extends from approximately 200 feet west of the Main Street Bridge described above to Airport Road, including sub-reaches E, F and the western portion of D (see Figure 2.4).

3.7.1.1 UPPER REACH

In general, the upper reach has more potential to support wetlands and riparian resources than do the middle and lower reaches. Along this reach, some bank stabilization work has been done, but less than the other two reaches considered. The natural floodplain is relatively undeveloped, and there are several off-channel areas primarily consisting of upland vegetation. These off-channel areas are located above normal creek flows and do not receive regular flooding events that would deposit sediment or flood root zones in order to support herbaceous hydrophytic vegetation. Large trees and shrubs are common throughout this reach, including Fremont cottonwood (*Populus fremontii*), Russian olive (*Elaeagnus angustifolia*), and narrowleaf willow (*Salix exigua*). All three species are considered hydrophytic species whose roots likely reach groundwater associated with Coal Creek.

At the very top of the reach, before the UP&L drop structure and just outside the project area, there is a scrub-shrub wetland on each side of the creek. The area above the UP&L drop structure has a wider active floodplain, and less incised banks. These conditions allow the active channel to spread out and meander, which in turn supports the wetlands on either side. In addition, groundwater seepage provides additional water for the wetlands. Dominant vegetation associated with these wetlands includes Fremont cottonwood, narrowleaf willow, narrowleaf cottonwood (*Populus angustifolia*), black-tip needle rush (*Juncus balticus*), reed canarygrass (*Phalaris arundinacea*), and smooth horsetail (*Equisetum laevigatum*). Both wetlands show signs of recent sediment deposits, watermarks, and debris lines.

Further downstream is a small wet meadow/scrub-shrub wetland on the south side of the creek; it is primarily influenced by a meander that rejoins the main channel downstream. Water from the meander crosses upstream of the wetland and, given sufficient volume, could probably flood the wetland. Here the dominant herbaceous vegetation is smooth horsetail, and the dominant woody vegetation is Fremont cottonwood and narrowleaf willow.

The final wetland found within the upper reach is located at the base of a deeply incised bank on the south side of the creek, upstream of the Center Street Park. It is a small depressional wet meadow with a predominance of black-tip needle rush. The wetland does not appear to be hydrologically connected to Coal Creek via a surface connection, though it may intercept groundwater traveling downgradient towards the creek. The wet meadow is approximately 50 feet south from the main channel, separated by an old floodplain that is now an upland area.

3.7.1.2 Middle Reach

Past channel modifications to straighten meanders, meet irrigation demands, control flooding, and adapt to growth demands have impacted the natural character of Coal Creek along the middle reach. These changes have decreased the potential for wetland and/or riparian areas to develop along the reach. Many portions along this reach have large rocks that have been deposited during high streamflow, leaving little opportunity for riparian vegetation to become established. Some small trees, including Fremont cottonwood, Russian olive, and narrowleaf willow, have established themselves within the rocky banks. However, bank-to-bank width is less than it is in the upper reach, and there is no opportunity for the channel to meander to create additional wetland or riparian areas.

Four irrigation canals begin at the Main Street Diversion, located just downstream of the Main Street Bridge. Three of the canals convey irrigation water to agricultural lands to the north, and the other conveys water to the south. Channel excavation and irrigation ditch maintenance have created levee-like mounds on either side of the creek and ditches. In this area, there are no rocks to stabilize the banks. Because the banks of the creek are very steep (45-60° slopes, and vertical in places) with little potential to support wetlands or riparian areas, and because the irrigation ditches remove the majority of water from the creek during the irrigation season, wetlands and riparian areas within existing channel are scarce. Several large trees, including narrowleaf cottonwood and Fremont cottonwood, are found on top of the levee-like mounds and on the sides of the steep creek banks.

3.7.1.3 Lower Reach

This reach has few to no existing wetlands or riparian resources, either within the present channel, or along the sides of the bank. The channel is straight and is maintained as needed to remove sediment accumulation, creating levee-like mounds on both sides of the channel. Some of the banks along this reach were modified in the spring of 2005 to accommodate the anticipated spring runoff. The Woodbury Diversion generally diverts the remaining low flow water out of the creek, leaving no water to support downstream wetlands or riparian resources along the channel.

3.7.2 Indicators

The indicator chosen to measure environmental effect on existing wetlands is acres of disturbance. The indicator chosen to measure environmental effect on existing riparian resources is linear feet of bank disturbance. The following sections analyze the effects of changes in stream bank width, parkway construction, parkway vegetation installation, construction associated with streambed improvements, and establishment of new potential wetlands and riparian resources within the project area.

3.7.3 Environmental Consequences of Alternative A: No Action

Under the No Action Alternative, there would be no changes in cross-sectional channel slopes or changes to the Main Street Diversion. Management and maintenance activities (i.e., periodic dredging just above the Main Street Bridge and west of the Main Street Diversion) would continue in the channel as they do currently. No parkway improvements would be made under the No Action Alternative.

3.7.3.1 Direct and Indirect Effects

Minimal adverse effects to wetland and riparian resources within the project area would occur in the upper and middle reaches of the creek under the No Action Alternative. There is little to no riparian vegetation in these reaches and the risk of mass wasting from unstable banks exists and would likely continue. The lower reach would not be impacted since the potential for riparian areas to become established is low as a result of seasonal stream dewatering. Dredging and bank stabilization that occurred as needed would not impact wetland resources since most work is done downstream of existing wetlands and potential habitat.

In the case of a 100-year flood event, the existing channel capacity and the current practice of dredging the channel upstream of the Main Street Bridge would not be sufficient to keep the flood waters in the channel. The flow of water out of the channel and across the existing floodplain could have direct and indirect effects on wetlands and riparian resources in the project area. Direct, adverse effects include removal of large trees and shrubs along the Coal Creek stream corridor, which would mean a reduction in natural erosion control, shade, and wildlife habitat.

3.7.3.2 Mitigation

Mitigation measures should include retention of existing riparian trees and shrubs to the maximum extent practicable to maintain long-term soil stability, shading, and wildlife habitat. Mitigation would also include revegetation of areas where hard bank stabilization is not necessary. This would include revegetation in areas where recent work has occurred with native riparian trees and shrubs (e.g., Fremont cottonwood, narrowleaf willow), which will encourage bank stabilization, provide instream shade to decrease water temperatures in the summer for the those portions of the creek that are able to maintain some flow, and provide wildlife habitat.

3.7.4 Environmental Consequences of Alternative B: Relocate Main Street Diversion

Alternative B involves relocating the Main Street Diversion to a site in the vicinity of 200 East (approximately 1,600 feet upstream from its present location). This would include the construction of a sedimentation basin to remove gravel from diverted irrigation water and the installation of approximately 3,250 feet of pipeline to transport water to the irrigation diversion structures, canals, and sedimentation basin.

Under Alternative B, the parkway, currently located in the easternmost portion of the project area, would be extended to Airport Road. The parkway would be landscaped with mostly native vegetation in sub-reaches A and B (from the UP&L drop structure to approximately the 200 East Bridge), and with non-native vegetation in sub-reaches C–F (downstream of the 200 East Bridge).

3.7.4.1 Direct and Indirect Effects

Relocating the Main Street Diversion to a site in the vicinity of 200 East would have direct, adverse effects on the riparian resources by dewatering the 1,600 foot long reach of Coal Creek between the location of the existing Main Street Diversion and the new diversion upstream to meet seasonal irrigation needs. This would result in a potential change in species composition and percent cover for riparian resources for approximately 1,600 linear feet of stream channel in the middle reach. This in turn could decrease riparian habitat quality, including a reduction in natural erosion control, increased water temperatures because of shade tree removal (instream shade typically benefits aquatic resources), and loss of existing riparian wildlife cover. Short-term, direct impacts associated with construction activities include nutrient enrichment of the creek via increased erosion, and increased turbidity following the removal of existing vegetation. Quality of wetlands in the project area would not be impacted by this alternative.

This alternative would also include bank stabilization and levee construction in portions of the project area to provide for flood conveyance and restrict the 100-year floodplain to the main channel. In the middle and lower reaches, proposed levees would impact 2,231 linear feet of stream channel, and proposed bank stabilization would impact 2,274 feet stream channel. Along the upper reach, approximately 6,988 feet of stream channel would be disturbed for bank stabilization. This disturbance would impact existing patches of riparian vegetation found within a total stretch of 11,493 feet of stream channel. However, as stated above, riparian vegetation in the upper and middle reach is very sparse (see Sections 3.7.1.1

through 3.7.1.3) and virtually nonexistent in the lower reach. Under this alternative, periodic dredging would continue, where and when necessary. To facilitate channel maintenance, an access easement would be maintained along the channel throughout the city.

Riparian resources would be not be impacted by the above mentioned construction or modification in the lower reach since no riparian areas exist, nor in the upper reach since the proposed work would be downstream. No riparian resources would be impacted by the construction of the sediment basin or addition pipeline construction, since none exist in the proposed locations. Alternative B would not negatively, directly or indirectly, affect any of the wetland resources within the project area, as they are located off-channel or within an area that would not be altered by the afore-mentioned improvements.

Similar to the No Action Alternative, long-term beneficial effects to riparian resources within the project area would occur in the upper reaches of the creek where bank stabilization work would be done. In areas where there is little to no riparian vegetation, or the risk of cave-ins from unstable banks exists, the ability to provide additional stabilized areas could increase riparian resources. Riparian resources may be positively impacted in the middle reach if levee and bank stabilization work occurred within this reach. The lower reach would not be impacted since the potential for riparian areas to become established is low as a result of seasonal stream dewatering (i.e., during peak irrigation demands). Dredging and bank stabilization that occurred as needed would not impact wetland resources since most work is done downstream of existing wetlands and potential habitat.

Parkway construction and the planting of native and non-native vegetation in the project area could have both adverse and beneficial effects on existing riparian resources. Direct, adverse effects include the crushing, trampling or removal of existing riparian vegetation along the banks during earth-moving activities and parkway installation, which would mean a possible net reduction in existing riparian wildlife habitat in the project area. Direct, beneficial effects include an increase in native riparian vegetation in potential habitat presently lacking riparian vegetation. Planting such vegetation could increase the erosion control potential of the revegetated areas, as well as improve and expand the existing suitable and potentially suitable wildlife habitat and instream shade.

3.7.4.2 MITIGATION

Mitigation measures should include:

- establishing minimum instream flows for 1,600 feet downstream of the relocated diversion structure to maintain those areas that currently have riparian vegetation,
- encouraging the establishment of riparian vegetation in those areas that are presently lacking and where hard bank stabilization is not necessary, and
- revegetating areas where recent work has occurred with native riparian trees and shrubs.

These measures would encourage bank stabilization, provide instream shade to decrease water temperatures in the summer for those portions of the creek that are able to maintain some flow, and provide wildlife habitat. As with Alternative B, disturbing existing, mature native trees along the riparian corridor should be avoided if possible during channel modification and maintenance to maintain long-term soil stability, shading, and wildlife habitat.

3.7.5 Environmental Consequences of Alternative C: Replace Main Street Diversion

Replacing the Main Street Diversion would affect existing riparian resources in the project area in a manner similar to Alternative B, with one main difference. Because the Main Street Diversion would be replaced at its present location, two sediment basins would be constructed near the diversion structure to remove gravel from diverted irrigation water. All other components of this alternative are similar to Alternative B.

3.7.5.1 Direct and Indirect Effects

Unlike Alternative B, by replacing the Main Street Diversion at its existing location, Coal Creek would not be dewatered during peak seasonal irrigation demands upstream of the Main Stream Diversion. In terms of riparian resources, Alternative C would provide direct, long-term, beneficial effects in comparison to Alternative B because there would be water in 1,600 linear feet of stream to help support existing patches of riparian vegetation year-round: from approximately 200 East to the replaced Main Street Diversion. Maintenance of this perennial flow would lead to indirect, long-term impacts, including decreased nutrient enrichment of the stream as a result of riparian vegetation acting as erosion control, stream-side shade that would benefit aquatic resources, the maintenance of wildlife habitat, and increased aesthetic value of Coal Creek. These streamflow impacts would be identical to those for Alternative A.

The remaining components of this alternative, including the sediment basin that would be constructed in an upland area, bank stabilization, and levee construction would have similar impacts as Alternative B.

The North Field Canal option would impact a total of 0.3 acres of riparian vegetation located along existing canals north of the Main Street diversion. These impacts would include direct construction impacts associated with placement of the pipeline, as well as indirect impacts that would result from removing the water from the canals and putting it into a pipeline.

3.7.5.2 Mitigation

For Alternative C, mitigation could include establishing minimum instream flows for maintaining those areas that currently have riparian vegetation. Under all alternatives, mitigation could include the establishment of riparian vegetation in those areas that do not require hard bank stabilization and are presently lacking riparian vegetation. Revegetation of disturbed areas would be done with native riparian trees and shrubs wherever possible. This would encourage bank stabilization, provide instream shade to decrease water temperatures in the summer, and provide wildlife habitat. Mitigation measures should also include retention of existing riparian trees and shrubs to the maximum extent practicable to maintain long-term soil stability, shading, and wildlife habitat.

3.8 Wildlife Resources (Including Threatened, Endangered, and Sensitive Species)

Twenty-six Special Status species and three big game species that occur within Iron County were analyzed as to their potential to occur within the Coal Creek project area. Of the Special Status species, 6 are federally listed by the USFWS, 19 are Utah state-listed species, and one is a conservation species (Table 3.13). Section 7 of the Endangered Species Act (ESA) requires that all federal agencies (including the NRCS) should participate in the conservation and recovery of federally-listed threatened and endangered species. Under this provision, federal agencies often enter into partnerships and Memoranda of Understanding (MOUs) with the USFWS for implementing and funding conservation agreements, management plans, and recovery plans developed for listed species. Section 7(a)(2) of the ESA indicates that federal agencies shall ensure that any action they authorize, fund, or carry out is not likely to jeopardize the continued existence of a federally-listed species or result in the destruction or adverse modification of designated critical habitat for the species. As part of this process, each agency must use the best scientific and commercial data available to determine the potential impacts to federally listed species and how best to avoid or mitigate these impacts (USFWS 1998).

Table 3.13. Special Status Species Known to Occur in Iron County and with Potential to Occur in the Coal Creek Project Area

Common Name	Scientific Name	Status	Potential Impacts	Notes
Bald eagle	*Haliaeetus leucocephalus*	T	Yes	Bald eagles winter in the area and may roost in large trees by the creek.
California condor	*Gynnogyps californianus*	Exp	No	These birds are tracked closely by the USFWS and generally are not in the proximity of the proposed project. This species would not be an issue for this project.
Western yellow-billed cuckoo	*Coccyzus americanus*	C	Yes	UDWR does have a sighting of a cuckoo in the general vicinity of the project area, most likely a migrant. However, the yellow-billed cuckoo habitat within the project area is not high-quality.

Table 3.13. Special Status Species Known to Occur in Iron County and with Potential to Occur in the Coal Creek Project Area, continued

Common Name	Scientific Name	Status	Potential Impacts	Notes
Mexican spotted owl	*Strix occidentalis lucida*	T	Yes	The 1997 Mexican spotted owl model indicates there is habitat in the vicinity of the project area. No MSOs have been detected in the project area.
Southwestern willow flycatcher	*Empidonax traillii extimus*	E	Yes	The riparian habitat within the project area is not dense enough to constitute suitable southwestern willow flycatcher habitat. However, the riparian zone could serve as a temporary resting or forgaging stopover for migrants.
Utah prairie dog	*Cynomys parvidens*	T	Yes	Utah prairie dogs do occur in the general vicinity of the project area.
Arizona toad	*Bufo microscaphus*	SPC	No	This toad is found in southern Utah, predominately in the Virgin River Basin. Habitat for the toad is not found in the project area.
Black swift	*Cypseloides niger*	SPC	No	In Utah and Colorado, this species is closely associated with waterfalls; it nests behind or in the spray of the waterfall. In Utah this species is only known from three breeding locations. It has been spotted in the general vicinity of the project area. However, there is no suitable black swift habitat in or near the project area.
Bonneville cutthroat trout	*Oncorhynchus clarki utah*	CS	No	This fish does not occur in Coal Creek or any downstream water bodies that Coal Creek flows into. Therefore, it would not be impacted by this project.
Brian head mountainsnail	*Oreohelix parawanensis*	SPC	No	This species occurs at a single locality in Iron County. They are not found near the project area, nor is there suitable habitat for them.

Table 3.13. Special Status Species Known to Occur in Iron County and with Potential to Occur in the Coal Creek Project Area, continued

Common Name	Scientific Name	Status	Potential Impacts	Notes
Burrowing owl	*Athene cunicularia*	SPC	Yes	This species breeds in burrows and is often associated with prairie dogs. Accordingly, it is possible that they occur in the project area.
Common chuckwalla	*Sauromalus ater*	SPC	No	This species occurs in desert communities with large rocky areas on hillsides. Habitat for this species is not found in the project area.
Dark kangaroo mouse	*Microdipodops megacephalus*	SPC	No	This species occurs in sagebrush desert with fine, gravelly soil. Suitable sagebrush habitat for this species does not occur within the project area.
Ferruginous hawk	*Buteo regalis*	SPC	Yes	This species could potentially occur within the project area.
Fringed myotis	*Myotis thysanodes*	SPC	Yes	This species occurs in a variety of habitats, including desert scrub. It roosts in tunnels, caves and buildings. It is wide-ranging but quite rare in Utah. Potential habitat for this species is found in the project area.
Greater sage-grouse	*Centrocercus urophasianus*	SPC	No	This species occurs in sagebrush habitat. However, suitable sagebrush habitat for this species does not occur within the project area.
Kit fox	*Vulpes macrotis*	SPC	No	This species occurs in arid areas of the state with soils suitable for denning. This habitat is not found within the project area.
Least chub	*Iotichthys phlegethontis*	SPC	No	This fish does not occur in Coal Creek and therefore would not be impacted by this project.

Table 3.13. Special Status Species Known to Occur in Iron County and with Potential to Occur in the Coal Creek Project Area, continued

Common Name	Scientific Name	Status	Potential Impacts	Notes
Lewis's woodpecker	*Melanerpes lewis*	SPC	No	This species has been documented in the general vicinity of the project area (UDWR 2005). It is a habitat specialist, breeding in ponderosa pine near open riparian areas. The project area does not have this habitat type; therefore, this species would not be impacted by this project.
Long-billed curlew	*Numenius americanus*	SPC	No	This species nests in dry grasslands. This habitat is not found near the project area.
Northern goshawk	*Accipiter gentilis*	SPC	No	There is no habitat for this species within the project area. However, there is potential habitat in the surrounding area, and a goshawk has been spotted within the vicinity of the project area (USFS Unpublished). Nonetheless, as development would be restricted to the project area, this species would not be impacted by this project.
Pygmy rabbit	*Brachylagus idahoensis*	SPC	No	This species is a sagebrush obligate and occurs in areas with deep soils and tall, dense sagebrush. They have been detected in the general vicinity of the project area (Durrant 1952). However, suitable sagebrush habitat for this species does not occur within the project area. Therefore, this species would not be impacted by this project.
Short-eared owl	*Asio flammeus*	SPC	No	This is an open-country, ground-nesting species that occupies grassland and tundra. These habitats are not found within the project area.

Table 3.13. Special Status Species Known to Occur in Iron County and with Potential to Occur in the Coal Creek Project Area, continued

Common Name	Scientific Name	Status	Potential Impacts	Notes
Spotted bat	*Euderma maculatum*	SPC	Yes	This species often occurs in dry desert terrain. Roosts are typically in rock crevices or under loose rocks. Roosts of this type may occur in the project area. This species has been detected in the general vicinity of the project area (Toone 1991).
Three-toed woodpecker	*Picoides tridactylus*	SPC	No	This species prefers high-elevation conifer forests. There is no suitable habitat for this species within the project area.
Townsend's big-eared bat	*Corynorhinus townsendii*	SPC	Yes	Suitable habitat for this species is typically associated with the caves and abandoned mines. Potential habitat may exist in the project area.

T = Federally Threatened
E = Federally Endangered
C = Federal Candidate
Exp = Federal Experimental Population
SPC = State Sensitive Species
CS = Conservation Species

The State of Utah also designates sensitive species in the Utah Sensitive Species List (UDWR 2005). Pursuant to UDWR Administrative Rule R657-48, wildlife species for which there is *credible scientific evidence to substantiate a threat to continued population viability*, will be designated as State Sensitive Species. Identifying these species allows land management agencies to implement *timely and appropriate conservation actions* to preclude the need to list these species under the ESA. In addition to those species specifically designated by UDWR, all federally-listed species, candidates for federal listing, and species for which a conservation agreement is in place automatically qualify for the Utah Sensitive Species List (UDWR 2005).

The following sections detail the affected environment with regard to wildlife and analyze how the alternatives of the Coal Creek project would affect both non-protected and Special Status wildlife species. Those wildlife species that are not Special Status species are discussed under the following general categories:

- Big game species (i.e., mule deer, black bear, and mountain lion)
- Upland game
- Raptors

- Reptiles
- Amphibians
- Non-game species (i.e., riparian and aquatic species and migratory birds)

3.8.1 Existing Conditions

3.8.1.1 Special Status Species

3.8.1.1.1 Bald Eagle

Southern Utah's wintering bald eagle (*Haliaeetus leucocephalus*) population is typically found near rivers, lakes, and marshes, where unfrozen, open waters provide the eagles with opportunities to prey on fish and waterfowl. The eagles begin to arrive in November and migrate back north by March. Utah also hosts a small population of desert bald eagles that can be found in desert valleys, far from any water. These eagles feed primarily on carrion such as road and hunter kill.

There are only five known nest sites in Utah, none of which occur near the project area. However, there are potential roost sites for bald eagle along Coal Creek, where the project would occur (Figure 3.9). Bald eagles have been documented in and around Coal Creek Canyon (Murie 1963).

3.8.1.1.1 Southwestern Willow Flycatcher

Southwestern willow flycatcher habitat is made up of riparian areas that generally contain tamarisk and other species such as Fremont cottonwood *(Populus fremontii)* and Goodding's willow *(Salix gooddingii)* that have the proper structure. Proper habitat structure is loosely defined as dense, woody riparian vegetation greater than 3 m (9.8 feet) in height with greater than 75% canopy cover. The riparian habitat along Coal Creek is found only within the upper reaches of the project area, from the canyon mouth to approximately one-half mile downstream. This habitat is narrow defined due to the incised nature of the channel and is generally at less than 10-20% canopy cover. This habitat is not dense enough to constitute suitable southwestern willow flycatcher habitat, and no southwestern willow flycatchers have been documented in the project area.

3.8.1.1.1 Western Yellow-billed Cuckoo

Western yellow-billed cuckoo (*Coccyzus americanus*) is a candidate species for federal listing under the ESA. Historically, the range of the western yellow-billed cuckoo included all states west of the Rocky Mountains, extending north into southern British Columbia and south into the northwestern states of Mexico. Currently, the range of the cuckoo is limited to fragments of riparian habitats from northern Utah, western Colorado, southwestern Wyoming, and southeastern Idaho, southward into northwestern Mexico and westward into southern Nevada and California. Cuckoos are long-range migrants that winter in northern South America in tropical, deciduous and evergreen forests. They are obligate riparian nesters, meaning they are restricted to more mesic wooded habitat along rivers, streams, and other wetlands. Other habitats used include mixed native associations (cottonwood, willow, ash, mesquite, sycamore, walnut), mixed native and introduced associations (any of the previous species with less than 75% tamarisk), mesquite bosque associations with more than 75% tamarisk, and even fruit orchards adjacent to rivers (i.e., artificial riparian habitat; Johnson et al. 1987, Laymon 1998). Western yellow-billed cuckoos feed on insects, including caterpillars and grasshoppers. Yellow-billed cuckoos prefer riparian habitat that is relatively dense with heavy canopy cover. The riparian habitat in the project area is typically less than 10-20% canopy cover and does not constitute suitable yellow-billed cuckoo habitat.

Yellow-billed cuckoos are notoriously difficult to observe in the wild due to their preference for heavy cover and their inconspicuous habits. However, UDWR does have record of a sighting of yellow-billed cuckoo (likely a migrant) in the general vicinity of the project area.

3.8.1.1.2 Mexican Spotted Owl (MSO)

Mexican spotted owl (MSO) (*Strix occidentalis lucida)* habitat includes high canopy closure, high stand density, and multi-layered canopies of uneven-age, forest-woodland stands. Steep slopes and canyons with rocky cliffs characterize much of the MSO's habitat. Within the Colorado Plateau, the owls are known to nest in steep-walled canyon complexes and rocky canyon habitat within desert scrub vegetation. The owl exists in small, isolated subpopulations and is threatened by habitat loss and disturbance from recreation, overgrazing, road development, catastrophic fire, timber harvest, and mineral development.

The project area is not located within designated critical habitat for this species. However, the 1997 MSO habitat model (Spotsky and Willey 1997) does indicate that potential MSO habitat exists within and around the project area (see Figure 3.9). Disturbance of this species would be most intense if it occurred during the nesting and breeding season, which begins in March; eggs are laid in late March or early April and hatch in early May. Nesting owls fledge from early to mid June and disperse out of the natal area in the fall.

3.8.1.1.3 Utah Prairie Dog

The Utah prairie dog's (*Cynomys parvidens)* range is limited to five counties in south-central Utah: Iron, Garfield, Piute, Wayne, Sevier. Historically, Utah prairie dogs inhabited nine Utah counties; populations were estimated at 95,000 prior to 1920. By the 1960s, the Utah prairie dog numbers and distribution were reduced due to disease, poisoning, drought, and habitat alteration due to cultivation and grazing. By 1972, the numbers had dwindled to an estimated 3,300 prairie dogs in 37 colonies (USFWS 1991).

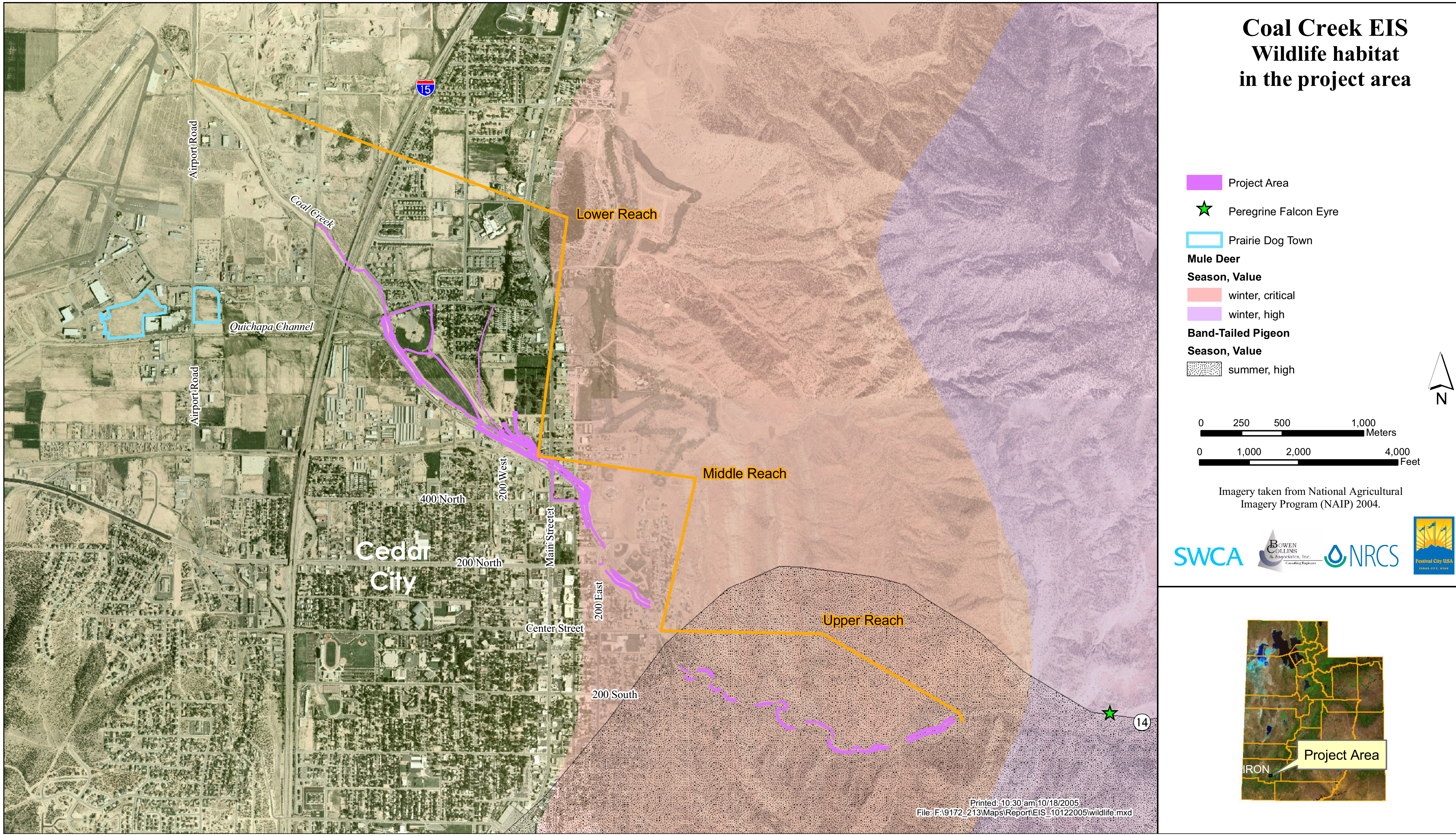

Figure 3.9. Wildlife habitat in the project area.

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This species lives in burrows located in deep, well-drained soil, with vegetation low enough that prairie dogs can see over or through, and suitable forage in the area. Availability of moist forage during the summer is also needed. Burrows are grouped into family territories (i.e., coterie), which coalesce to form larger colonies or "towns." Distribution and communication within the colony facilitates predator avoidance (Spahr et al. 1991).

The project area was surveyed for Utah prairie dogs on May 3, 2005. Two active Utah prairie dog towns were located near the project area. The first town was located 60 m north of the Quichapa Channel, east of Airport Road (see Figure 3.9). This Utah prairie dog town was recorded with a GPS unit and was found to be 7.8 acres (3.2 ha). A second Utah prairie dog town was identified 225 m west of the Quichapa Channel, west of Airport Road (see Figure 3.9). The town was mapped with a GPS unit and was found to be 14.9 acres (6.0 ha).

3.8.1.1.4 BURROWING OWL

The burrowing owl (*Athene cunicularia)* is listed as a State Sensitive Species due to recent decreases in population size. Burrowing owls are neo-tropical migrants, nest underground in burrows, and are typically found in open desert grassland and shrubland areas that are level and well-drained (Gleason and Johnson 1985). The owls depend on burrowing mammals to provide their nest sites and are often associated with prairie dog colonies (Konrad and Gilmer 1984). The decline of the owl's population across its range appears to be due primarily to agricultural practices, use of pesticides, and the decline of prairie dog colonies (Haug et al. 1993).

Potential burrowing owl habitat in the project area is identical to the prairie dog towns described above. The project area was surveyed for burrowing owls on May 3, 2005, but no burrowing owl individuals or burrowing owl signs were detected within the project area.

3.8.1.1.5 FERRUGINOUS HAWK

The ferruginous hawk (*Buteo regalis)*, a State Sensitive Species, is the largest of the North American buteos. It is a neo-tropical migrant with a breeding range from southwestern Canada to central Arizona, New Mexico, and northern Texas and a wintering range extending from California to northern Mexico. It is a year-round resident in the area from Nevada, western and southern Utah, northern Arizona, and New Mexico, to eastern Colorado and South Dakota. In Utah, the ferruginous hawk nests at the edge of juniper habitats and open, desert and grassland habitats in the western, northeastern, and southeastern portions of the state. Ferruginous hawks are highly sensitive to human disturbance and have been threatened by habitat loss from oil and gas development, agricultural practices, and urban encroachment. They have experienced a decline across much of their range and have been extirpated from some of their former breeding grounds in Utah.

There is potential habitat within the project area. A raptor survey was conducted by SWCA on May 3, 2005, but no ferruginous hawk nests or ferruginous hawks were identified in the project area.

3.8.1.1.6 FRINGED MYOTIS

The fringed myotis (*Myotis thysanodes)* is listed as a Sensitive Species because of limited distribution within the state. This species occurs predominantly in southern Utah, although records of this species occur throughout the state. Fringed myotis occur in a variety of habitats, including riparian, desert shrub, pinyon-juniper, mountain meadow, ponderosa pine, and montane forest (Miller 1934). Although there is potential habitat within the project area, no fringed myotis have been recorded in the area.

3.8.1.1.7 SPOTTED BAT

The spotted bat (*Euderma maculatum)* is listed as a Sensitive Species and is considered rare in Utah (though the spotted bat's distribution ranges throughout the Western states from British Columbia to Mexico). The spotted bat has a very low reproductive potential; therefore, once populations are reduced, they rebuild very slowly. There is potential spotted bat habitat within the project area, and a bat has been documented within the project area (Toone 1991).

3.8.1.1.8 TOWNSEND'S BIG-EARED BAT

The Townsend's big-eared bat (*Corynorhinus townsendii*) is a Sensitive Species due to its limited distribution and declining population (Oliver 2000). The Townsend's big-eared bat is quite sensitive to human disturbance, which is likely the primary cause of its population decline. The Townsend's big-eared bat is a cave-roosting species that moves into man-made caves such as mines and buildings. Unlike many other bats, they are unable to crawl into crevices and usually roost in enclosed areas where they are vulnerable to disturbance. This bat is colonial during the maternity season, when compact clusters of up to 200 individuals might be found. Maternity roosts form in the spring and remain intact during the summer. Site fidelity is high, and if undisturbed, the bats will use the same roost for many generations (Brown 1996).

Although there is potential habitat within the project area, no Townsend's big-eared bats are known to occur in the project area.

3.8.1.2 MULE DEER

Mule deer (*Odocoileus hemionus*) occupy most ecosystems in Utah but likely attain their greatest densities in shrublands or other areas characterized by rough, broken terrain and abundant browse and cover. In the Rocky Mountains, the mule deer's winter diet consists of approximately 75% browse from a variety of trees and shrubs, 15% forbs, and 10% grasses. In the spring, browse is 49% of the diet and grasses and forbs make up approximately 25% each. Summer diets are 50% browse, with forbs consumption increasing to 46%. Browse use increases again in the fall to approximately 60% of the mule deer diet, forb use declines to 30%, and grasses increase to 10% (Fitzgerald et al. 1994).

Mule deer summer range habitat types include spruce/fir, aspen, alpine meadows, and large grassy parks located at higher elevations. Winter range habitat primarily consists of shrub-covered; south facing slopes and often coincides with areas of concentrated human use and occupation. For this reason, winter range is often considered a limiting factor for mule deer in the Intermountain West (Robinette 1966).

Because of learned behavioral use patterns, mule deer migrate into the same areas every winter, regardless of forage availability or condition. These generally are areas lacking snow depth, with pinion-juniper and sagebrush vegetation types. These vegetation types provide deer with both escape and thermal cover, and sagebrush is their primary forage during the winter season (Oedekoven and Lindzey 1987).

Over the past five years, fawn production has been poor, and the overall deer population has been declining in Utah. Poor range conditions caused by severe drought could be a major factor causing the population decline.

The project area, according to the UDWR, falls within mule deer critical winter habitat (Miller 1934).

3.8.1.3 Black Bear

In the Intermountain West, black bears (*Ursus americanus*) are typically associated with forested or brushy mountain environments and wooded riparian corridors and seldom use open habitats (Zeveloff and Collett 1988). Black bears tend to be nocturnal, crepuscular, and omnivorous. Preferred foods include berries, honey, fish, rodents, birds and bird eggs, insects, and nuts. Black bears obtain most of their meat from carrion. From November to April, the bears enter a period of winter dormancy. Winter dens are located in caves, under rocks, or beneath the roots of large trees where they are kept nourished and insulated by a several-inch-thick layer of fat (Zeveloff and Collett 1988).

According to UDWR data, the entire project area falls within high–value, year-long, black bear habitat. However, actual black bear habitat within the project area is most likely found only upstream of the mouth of Cedar Canyon.

3.8.1.4 Mountain Lion (Cougar)

The mountain lion or cougar (*Felis concolor*) likely inhabits most ecosystems in Utah. However, it is most common in the rough, broken terrain of foothills and canyons, often in association with montane forests, shrublands, and pinyon-juniper woodlands (Fitzgerald et al. 1994). Mule deer is the mountain lion's preferred prey species. Consequently, mountain lion seasonal use ranges generally closely parallel those described above for mule deer. Mountain lions have been observed in the vicinity of the project area (personal communication with Martin Tyner, Southwest Wildlife Foundation, April 2005).

3.8.1.5 Upland Game

Annual fluctuations of most upland game bird and small mammal populations very closely correlate with annual climatic patterns. Mild winters and early spring precipitation during the months of March, April, and May are associated with increases in upland game populations. Warm, dry weather, especially during June, is generally considered vital for the survival of newborn young of many upland game species.

Upland game in the project area includes potential habitat for species such as the Rio Grande turkey (*Maleagris gallopavo*), ring-necked pheasant (*Phasianus colchicus*) and band-tailed pigeon (*Columba fasciata*), to name a few. The project area falls within summer high-value habitat southeast of the mouth of Cedar Canyon for the band-tailed pigeon.

3.8.1.6 Raptors

Special habitat needs for raptors include nest sites, foraging areas, and roosting or resting sites. Buffer zones are usually recommended around raptor nest sites for the early spring and summer, when raptors are raising their young. Some of the most utilized raptor nesting habitats in Utah are generally found along riparian areas and cliff faces. Juniper-desert shrub transition areas are also identified as being important for nesting ferruginous hawks.

Raptor surveys were completed in the Coal Creek project area by SWCA on May 3, 2005. No nests (active or non-active) were detected within the project area. However, there is one peregrine falcon (*Falco peregrinus*) eyrie in the project vicinity, which may have been active in 2005 (personal communication with Martin Tyner, Southwest Wildlife Foundation, April 2005; see Figure 3.9). Raptor surveys will be completed for a second time in 2006 before construction begins. These surveys will be used to ascertain whether any raptors are present within the vicinity of the project area and whether any spatial and/or temporal no-activity buffers will need to be imposed.

3.8.1.7 Reptiles, Amphibians, and Other Non-game Species

The various riparian and pinyon-juniper habitats in the project area are used by a high diversity of reptile, amphibian, and other non-game species, including small mammals, birds, and invertebrates. Very little is known about the status of most of these species in the project area. However, it can be ascertained that the little riparian habitat currently left on Coal Creek would provide some of the most productive habitat for these species in the project area.

3.8.1.7.1 Riparian and Aquatic Species

Although the reach of Coal Creek where the project would occur has no resident fish populations, many riparian and amphibian species are highly dependent on riparian and wetland areas. The project area was surveyed for wetland and riparian resources on April 27 and 28, 2005 and was divided into three reaches—upper, lower, and middle—each of which includes the sub-reaches described in Chapter 2 (see Figure 3.9).

The upper reach extends from the eastern boundary of the project area to just southeast of Center Street (sub-reach A), where the Coal Creek banks begin to be more channeled and confined by vertical clay banks and rock. There are large trees and shrubs in this stretch, including Fremont cottonwood (*Populus fremontii*), Russian olive (*Elaeagnus angustifolia*), and narrowleaf willow (*Salix exigua*). There is a scrub wetland on both sides of the creek. Dominant vegetation associated with this wetland includes Fremont cottonwood, narrowleaf willow, narrowleaf cottonwood (*Populus angustifolia*), black-tip needle rush (*Juncus balticus*), reed canarygrass (*Phalaris arundinacea*), and smooth horsetail (*Equisetum laevigatum*). This wetland habitat is also beneficial for a variety of species, including birds and macroinvertebrates.

The middle reach extends from a point southeast of the Center Street Bridge to a point 200 feet west of the Main Street Bridge (sub-reaches B and C and the eastern portion of sub-reach D). Past channel modifications to straighten meanders, meet irrigation demands, control flooding, and adapt to growth demands have impacted the natural character of Coal Creek along this middle reach. These changes have decreased the potential for wetland and/or riparian areas to develop along the reach. Some small trees, including Fremont cottonwood, Russian olive, and narrowleaf willow, have established themselves within the rocky banks. Several large trees, including narrowleaf cottonwood and Fremont cottonwood, are found here on top of the levee-like mounds and sides of the steep creek banks. The middle reach provides only poor to marginal habitat for riparian and aquatic species.

The lower reach extends from approximately 200 feet west of the Main Street Bridge to Airport Road (sub-reaches E and F and the western portion of sub-reach D). This reach has little to no existing wetland or riparian resources, either within the present channel or along the sides of the bank. This stretch provides little to no habitat for riparian or aquatic species.

3.8.1.7.2 Migratory Birds

The Migratory Bird Treaty Act (16 U.S.C. §§ 703-712, July 3, 1918, as amended) prohibits (unless permitted by regulations) the taking, killing, or possessing of migratory birds. This applies but is not limited to waterfowl, shorebirds, migratory songbirds, and raptors. Executive Order 13186, *Responsibilities of Federal Agencies to Protect Migratory Birds*, mandates additional measures by federal agencies to support the conservation intent of the Migratory Bird Treaty Act. It requires, among other things, that federal agencies avoid or minimize adverse impacts on migratory bird resources, to the extent practicable. Agencies are also directed to restore or enhance migratory bird habitat wherever possible within the constraints of their management policies and objectives.

Numerous species of neo-tropical migratory birds can be found utilizing various habitats within and around the project area at different times of the year. The riparian areas are potentially the most useful areas for nesting, roosting, and foraging and may show the greatest diversity of species. Some of the more common and visible birds within the project area include raptors such as red-tailed hawk (*Buteo jamaicensis*), turkey vulture (*Cathartes aura*), northern harrier (*Circus cyaneus*), prairie falcon (*Falco mexicanus*), American kestrel (*F. sparverius*), and great-horned owl (*Bubo virginianus*). All raptors are protected under the Migratory Bird Treaty Act of 1918, which makes it unlawful to pursue, hunt, kill, capture, possess, buy, sell, or barter any migratory bird feathers or other parts, such as, nests, eggs, or other products.

Neo-tropical migratory birds that could potentially inhabit the project area include sage sparrow (*Amphispiza belli*), blue-gray gnatcatcher (*Polioptili caerulea*), western kingbird (*Tyrannus verticalis*), Virginia's warbler (*Vermivora virginiae*), black-chinned hummingbird (*Archilochus alexandri*), black-throated gray warbler (*Dendroica nigrescens*), gray vireo (*Vireo vicinior*), green-tailed towhee (*Piplio chiorurus*), Say's phoebe (*Sayornis saya*), savannah sparrow (*Passerculus sandwichensis*), vesper sparrow (*Pooecetes gramineus*), black-throated sparrow (*Amphispiza bilineata*), gray flycatcher (*Empidonax wrightii*), Cassin's kingbird (*Tyrannus vociferans*), and white-throated swift (*Aeronautes saxatalis*).

3.8.2 Indicators

The indicators for impacts to wildlife are essentially the acreage of impacts to the habitat of the species in question or the amount of activity and development. In some cases, specific elements of the habitat, such as the presence/absence of roosting trees for eagles can be analyzed.

3.8.3 Environmental Consequences of Alternative A: No Action

The No Action Alternative includes continued dredging in the channel when and where necessary. No erosion control, streambank hardening, or parkway improvements would be implemented under the No Action Alternative.

3.8.3.1 Direct and Indirect Effects

3.8.3.1.1 Special Status Species

Bald Eagle

As stated previously, large trees and shrubs—including Fremont cottonwood, Russian olive, and narrowleaf willow—that are found in the riparian areas, upland areas, and wetlands of the project area provide potential roost habitat for bald eagles. However, although Coal Creek does have perennial flow, there are no fish associated with the creek. Accordingly, this alternative would not affect the food source for bald eagles wintering in the general area or roosting on riparian trees. Additionally, from March through October, there would be absolutely no direct effects to eagles, as they spend this time in regions north of the project area.

Direct, short-term effects from noise and human activity during continued, routine dredging of the creek would likely have very little effect on the wintering, roosting bald eagles, other than inducing the birds to move to roost sites along the stream away from the area. It should be noted that the upper reach of the creek provides the only likely sites for roosting eagles, and that dredging in this reach is unlikely to occur, as this reach already has adequate capacity to carry the anticipated 100-year flood event (see Chapter 2).

Southwestern Willow Flycatcher

Under the No Action Alternative, no direct removal of riparian habitat for southwestern willow flycatcher would occur. There would be short-term direct effects from noise and human activity associated with routine channel maintenance of Coal Creek. However, these impacts would likely be confined to any incidental flycatchers that may be stopping over to rest or forage in the project area during the spring or fall migration.

The No Action Alternative would likely have a long-term, adverse impact on southwestern willow flycatcher habitat because the existing channel design and the current practice of dredging the channel downstream of the Main Street Bridge would not be sufficient to keep the 100-year flood waters in the channel. The flow of water out of the channel and across the existing floodplain could have direct and indirect, negative effects on vegetation in the project area, including exposing the roots and washing away large trees and shrubs along the Coal Creek stream corridor, which would mean a reduction in what little natural erosion control, shade, and flycatcher habitat remains.

Western Yellow-billed Cuckoo

Impacts to western yellow-billed cuckoo under the No Action Alternative would be similar to those described for southwestern willow flycatcher.

Mexican Spotted Owl (MSO)

Direct, short-term effects from noise and human activity during continued, routine creek work would most likely have little to no effect on the MSO 1997-modeled habitat (Spotsky and Willey 1997). Considering the time of year that rip-rap construction has taken place within the canyon, (late winter/early spring), it likely has not disturbed any potential MSOs, since they nest later in the season.

Utah Prairie Dog

The No Action Alternative would have no effect on the two prairie dog towns, which are located close to the project area.

Burrowing Owl

No burrowing owls were detected near the project area. The only potential habitat found in the vicinity of the project area were the two prairie dog towns found on May 3, 2005. Since the No Action Alternative does not threaten these prairie dog towns, it does not threaten the potential burrowing owl habitat. Accordingly, it is unlikely that the No Action Alternative would have any impact on burrowing owls.

Ferruginous Hawk

During the 2005 surveys, no individual ferruginous hawks or nests (active or non-active) were detected within the project area. Although there is potential habitat within the project area, it is unlikely that the No Action Alternative (i.e., continued management) would have any impact on ferruginous hawk.

Fringed Myotis

During the 2005 surveys, no fringed myotis or roost sites were detected within the project area. Although there is potential habitat within the project area, it is unlikely that the No Action Alternative (i.e., continued management) would have any impact on the fringed myotis.

Spotted Bat

A spotted bat has been detected near the project area (Toone 1991), and spotted bat habitat, which is similar to MSO habitat, does occur near the project area. However, as the No Action Alternative would have little effect on MSO habitat, it would also have negligible impact on this species.

Townsend's Big-eared Bat

During the 2005 surveys, no Townsend's big-eared bat or roost sites were detected within the project area. Although there is potential habitat within the project area, it is unlikely that the No Action Alternative (i.e., continued management) would have any impact on Townsend's big-eared bat.

3.8.3.1.2 MULE DEER

The project area, according to UDWR, falls within mule deer critical winter habitat south-east of the mouth of Cedar Canyon. Continued dredging of the channel may temporarily disturb any mule deer in the immediate area, causing them to leave the creek, as it has in the past. However, the No Action Alternative would have no long-term effects on mule deer or their critical wintering habitat.

3.8.3.1.3 BLACK BEAR

The entire project area falls within high-value, year-long, black bear habitat. However, ideal black bear habitats somewhat more remote, starting at the mouth of Cedar Canyon.

There is unlikely to be any continued dredging or other channel maintenance in or near the mouth of the canyon. It the event that some maintenance of the channel or the existing diversion structure is necessary, it is unlikely that this disturbance would do more than induce the black bear to avoid the area immediately adjacent to the stream. For these reasons, the No Action Alternative would have no long-term effects on the black bear or its high-value, year-long habitat.

3.8.3.1.4 Mountain Lion (Cougar)

The No Action Alternative would cause disturbances to mountain lion similar to those described for mule deer, above. However, continued management would not have long-term impacts on mountain lion habitat.

3.8.3.1.5 Upland Game

Other then the short-term, temporary disturbance of the noise and general human activity of dredging within the creek, there would be no other effects to upland game in the vicinity of the project area.

3.8.3.1.6 Raptors

As stated previously, raptor surveys were completed by SWCA on May 3, 2005 and will be completed for a second time in 2006 before construction begins. Presently the only raptor nesting within one-half mile of the project area is a pair of peregrine falcons that have an eyrie high up upon the cliffs north of the upper reach of the creek. The No Action Alternative would have no impact on these raptors.

3.8.3.1.7 Reptiles, Amphibians, and Other Non-game Species

The No Action Alternative generally would cause some short-term impacts to reptiles, amphibians, and non-game species occurring near or within the creek. These impacts would be in large part due to the dredging and the movement of the heavy equipment in the area, which would disturb individual animals and potential habitat. Although routine channel maintenance would have short-term impacts on habitat, it is possible that it would result in individual mortality to reptiles and amphibians using the stream channel. Moreover, annual channel maintenance would prevent the establishment of perennial riparian and wetland herbaceous vegetation, which provides cover for these species.

Riparian and Aquatic Species

The direct effects of the No Action Alternative on the abundance of wetlands and riparian resources within the project area would be minimal for the upper, middle, and lower reaches. However, in the case of a 100-year flood event, the existing streambank design and the current practice of dredging the channel downstream of the Main Street Bridge would not be sufficient to keep the 100-year flood waters in the channel. The flow of water out of the channel and across the existing floodplain could have direct and indirect, negative effects on vegetation in the project area, including exposing the roots and washing away large trees and shrubs along the Coal Creek stream corridor, which would mean a reduction in what little natural erosion control, shade, and wildlife habitat remains.

Migratory Birds

Many neo-tropical migratory bird species are highly dependent on riparian areas. The No Action Alternative would have minimal direct effects on the riparian habitat used by these species. However, in the case of a 100-year flood event, the inability of the existing creek to carry this level of flood would result in the disturbance or loss of the little remaining migrating bird habitat along the creek.

3.8.3.2 MITIGATION

No mitigation measures are planned for the No Action Alternative.

3.8.4 ENVIRONMENTAL CONSEQUENCES OF ALTERNATIVE B: RELOCATE MAIN STREET DIVERSION

3.8.4.1 DIRECT AND INDIRECT EFFECTS

3.8.4.1.1 SPECIAL STATUS SPECIES

Bald Eagle

Coal Creek has some riparian habitat attractive to wintering bald eagles for roosting, but it does not provide foraging eagles with fish. Therefore, this alternative would have few direct, short-term or long-term effects on bald eagles wintering in the area. From March through October, there would be absolutely no direct effects to eagles, as they spend this time in regions north of the project area. If project construction does occur between the months of November and March, the noise associated with the project may temporarily displace wintering birds from their roosts.

A potential direct effect to bald eagle habitat could include the occasional damage or removal of potential roosting trees within the project area. However, it should also be noted that all the action alternatives include restrictions to avoid, whenever possible, the disturbance or removal of existing cottonwood, willow, and other native riparian vegetation occurring along the stream. Additional mitigation for this impact is provided in Section 3.8.4.2.

Southwestern Willow Flycatcher

Construction and earth-moving activities associated with relocating the Main Street Diversion, channel modifications, and streambank hardening could have direct and indirect, adverse effects on approximately 11,493 linear feet of stream channel in the project area. However, only 6,998 linear feet (the upper reach) supports any riparian habitat. Disturbance in this reach would have short-term impacts on the remaining riparian habitat in the reach, including the removal of shade trees, and temporary loss of some flycatcher habitat. However, it should be noted that the riparian vegetation in this reach of Coal Creek is very sparse, typically representing less than approximately 10% canopy cover, and the loss of this habitat is unlikely to have a measurable effect on any flycatchers that may be migrating through or residing in the project area.

The greatest long-term potential impact of moving the Main Street Diversion to approximately 200 East is the piping of the diverted water from this point to canals near the existing Main Street Diversion. This would remove a large portion of perennial flow in the Coal Creek channel during the irrigation season, which would effectively result in the loss of what little remaining riparian habitat is found from 200 East to the Main Street Diversion (the middle reach). Although this riparian habitat is not suitable for southwestern willow flycatcher, removal of this perennial flow would prevent the potential restablishment of any riparian vegetation for this species and may adversely impact any individual flycatchers that have been using this habitat as stopover resting or foraging habitat during the spring and fall migration.

Parkway construction and the planting of native and non-native vegetation in the project area could have direct and indirect, adverse and beneficial effects on existing riparian resources. Direct, adverse effects include the crushing, trampling, or removal of riparian vegetation along the banks during earth-moving activities and parkway installation, which would mean a possible short-term reduction in flycatcher resting habitat in the project area. Direct, beneficial effects would include a restoration of riparian vegetation along the stream channel, due to post-project revegetation. This could increase the erosion control potential, as well as potentially provide suitable flycatcher habitat.

Yellow-Billed Cuckoo

Impacts to yellow-billed cuckoo under this alternative would be similar to those described above for southwestern willow flycatcher.

Mexican Spotted Owl (MSO)

No major changes within the canyon are planned under Alternative B. Direct, short-term effects from noise and human activity during site-specific bank stabilization activities would most likely have little to no effect on the MSO 1997-modeled habitat (Spotsky and Willey 1997).

Utah Prairie Dog

The impacts would be similar to those described under Alternative A.

Burrowing Owl

The impacts would be similar to those described under Alternative A.

Ferruginous Hawk

The impacts would be similar to those described under Alternative A.

Fringed Myotis

The impacts would be similar to those described under Alternative A.

Spotted Bat

The impacts would be similar to those described under Alternative A.

Townsend's Big-eared Bat

The impacts would be similar to those described under Alternative A.

3.8.4.1.2 Mule Deer

According to UDWR, the portion of the project area east of 100 East (Figure 3.9) falls within mule deer critical winter habitat.

Parkway Option B1 would cause 11.31 acres of temporary, direct disturbance to the critical winter habitat of the mule deer, while Parkway Option B2 would cause 11.20 acres of temporary, direct disturbance, compared to the No Action Alternative. The noise and increased human activity associated with bank stabilization and other construction would not only directly disturb the habitat, but may also cause a temporary disturbance to mule deer individuals in the area. Likely, deer in close proximity to the disturbance would move up the canyon to higher elevations above impacted sections of the stream.

However, the loss of critical wintering habitat in Alternative B would be temporary and of short duration. Neither the long-term, direct nor the short-term, indirect impacts to this crucial deer winter range would have an appreciable impact on mule deer populations in the general area around Cedar City. The long-term loss of mule deer habitat due to channel modifications and parkway construction would be comparatively small in relation to existing habitat. Accordingly, this alternative would have negligible long-term impacts to mule deer. However, the long-term indirect impacts from the increased use of Parkway may cause mule deer to be more wary of areas frequented by humans.

3.8.4.1.3 Black Bear

As stated previously, even though the entire project area falls within high-value, year-long black bear habitat, the ideal black bear habitat is somewhat more remote, starting at the mouth of Cedar Canyon. If bears indeed prefer habitat in the canyon, starting at the mouth, the impacts to high-value black bear habitat would be similar to impacts to mule deer habitat under Alternative B.

Therefore, Parkway Option B1 would cause 11.31 acres of temporary, direct disturbance to the high-value habitat of the black bear, while Parkway Option B2 would cause 11.20 acres of temporary, direct disturbance, compared to the No Action Alternative. Similarly, the noise and increased human activity associated with bank stabilization that would occur in this area under Alternative B may cause a temporary disturbance to black bear individuals in the area, inducing them to move away from the streamside areas where work is occurring. However, it should be noted that channel modifications and bank stabilization in the upper reach (where bears are most likely to be found) would be considerably less than in the middle and lower reaches and are unlikely to have a substantial impact on black bears.

The long-term loss of black bear habitat due to channel modifications and parkway construction would be comparatively small in relation to existing habitat. Accordingly, this alternative would have negligible long-term impacts to black bear.

3.8.4.1.4 Mountain Lion (Cougar)

Mountain lion seasonal use ranges closely parallel those of mule deer. The temporary loss of critical deer winter habitat may have a short-term impact on the available forage for mountain lion in the immediate vicinity of the upper reach of Coal Creek. Additionally, the noise and increased human activity associated with bank stabilization in this area may cause a temporary disturbance to mountain lion individuals in the area. However, these impacts would be short-term and are unlikely to adversely affect the survivability or population viability of any mountain lions residing in or around the project area.

3.8.4.1.5 Upland Game

Under Alternative B, the bank stabilization work that would occur in this area may cause a temporary disturbance to upland game, including potentially nesting band-tailed pigeons. Alternative B, both Parkway Options B1 and B2, would impact 6.01 acres of band-tailed pigeon habitat. However, this acreage amounts to a relatively small percentage of total pigeon habitat; therefore, this alternative would have little impact on any potential pigeon populations residing in or near the project area.

3.8.4.1.6 Raptors

It is unlikely that any activity associated with Alternative B would have any effect on the peregrine falcon eyrie (see Section 3.8.1.6). Raptor surveys will be conducted a second time in 2006 before construction begins.

3.8.4.1.7 Reptiles, Amphibians, and Other Non-game Species

This alternative would likely result in some short-term, negative impacts to reptiles, amphibians and non-game species but it is impossible to gauge the exact extent of the impacts. However, given that the ground disturbance is greater than the disturbance in the No Action Alternative, it is fair to state the impacts would be greater than they would be in the No Action Alternative. The impacts would most likely be quite minimal and of short duration because they would only occur during construction. The details of these impacts are given below.

Riparian and Aquatic Species

Construction and earth-moving activities associated with relocating the Main Street Diversion, channel modifications, and streambank hardening could have direct and indirect, adverse effects on approximately 11,493 linear feet of stream channel in the project area. However, only 6,998 linear feet (the upper reach) supports any riparian habitat. Disturbance in this reach would have short-term impacts on the remaining riparian habitat in the reach, including the removal of shade tree and refuge habitat. However, it should be noted that the riparian vegetation in this reach of Coal Creek is very sparse, typically representing less than approximately 10% canopy cover, and the loss of this habitat is unlikely to have a substantial impact on the population viability of riparian and aquatic species in the project area.

The greatest impact of this alternative on riparian and aquatic species would be associated with moving the Main Street Diversion to approximately 200 East and piping diverted water from this point to canals near the existing Main Street Diversion. This alternative would remove a large portion of perennial flow in the Coal Creek channel during the irrigation season, which would effectively result in the loss of what little remaining riparian habitat is found from 200 East to the Main Street Diversion. The elimination of this riparian habitat could result in both individual mortality and potential extirpation of amphibious species using this stretch of the creek.

Parkway construction and the planting of native and non-native vegetation in the project area could have both adverse and beneficial effects on existing riparian resources. Direct, adverse effects include the crushing, trampling, or removal of riparian vegetation along the banks during earth-moving activities and parkway installation, which would mean a possible reduction in non-game habitat in the project area. Direct, beneficial effects would include a restoration of native riparian or other vegetation along the stream channel, due to revegetation. This could increase the erosion control potential, as well as permanently improve and expand the existing suitable and potentially suitable amphibian and other non-game habitat. If riparian habitat is increased, it would provide additional instream shade. Additional instream shade could decrease summertime water temperatures, which in turn could increase water quality and improve refuge habitat for amphibians such as frogs and salamanders along those sections of Coal Creek where the parkway would be constructed.

Migratory Birds

Relocating the Main Street Diversion to a site in the vicinity of 200 East and installing a new pipeline would have direct, adverse effects on the species composition and percent cover of riparian resources for a total of approximately 11,493 linear feet stream channel during the construction process. However, only 6,998 linear feet of the upper reach of Coal Creek supports riparian habitat. Of this riparian habitat, approximately 10 percent of the linear feet includes suitable habitat for nesting, roosting, or foraging of migratory birds. The area of potential effect that includes this habitat ranges from 10 to 20 feet on either side of the river in this upper reach. Accordingly, approximately 0.50 to 0.75 of an acre of migratory bird habitat in this upper reach would be temporarily impacted by the proposed project. It should be noted that this habitat is scattered and other generally poor quality and the stabilization and subsequent revegetation of this reach would likely improve the migratory bird habitat quality in this area in the long-term.

Parkway construction and the planting of native and non-native vegetation in the project area could have direct and indirect, adverse and beneficial effects on existing riparian resources. Direct, adverse effects include the crushing, trampling, or removal of riparian vegetation along the banks during earth-moving activities and parkway installation, which would mean a possible reduction in migratory bird habitat in the project area at least in the short. Direct, beneficial effects would include a restoration of native riparian vegetation along the stream channel, due to revegetation. This could increase the erosion control potential, as well as permanently improve and expand the existing suitable and potentially suitable migratory bird habitat and instream shade.

3.8.4.2 Mitigation

Mitigation measures could include the following:

1. Raptor surveys should be conducted before construction begins.
2. If active nests are found, spatial and temporal buffers should be placed around the active nests, according to the USFWS guidelines (Romin and Muck 1999).
3. Provide maintenance flows in the stream from 200 East to the Main Street Diversion. This flow, of course, would be contingent on securing appropriate water rights.
4. Avoid, whenever possible, existing cottonwood, willow, and other native riparian vegetation occurring along the stream.
5. Wherever possible, trees will be planted along the reconstructed stream channel to maintain potential roosting sites for bald eagle, as well as nesting sites for neo-tropical migrants.
6. Roost platforms for bald eagles would be constructed in areas where documented bald eagle roosting occurs and trees will be removed because of proposed stabilization.
7. Surveys for nesting neo-tropical migrants will be conducted prior to construction.
8. If active neo-tropical migrant nests are found, construction would be avoided within 1,000 feet of the active nests during the nesting season.

3.8.5 Environmental Consequences of Alternative C: Replace Main Street Diversion

3.8.5.1 Direct and Indirect Effects

3.8.5.1.1 Special Status Species

Bald Eagle

The impacts would be similar to those described under Alternative B.

Southwestern Willow Flycatcher

Alternative C would have fewer long-term, indirect impacts to the southwestern willow flycatcher than Alternative B, but similar impacts to Alternative A. This is due to both Alternatives A and C not requiring the relocation of the Main Street diversion structure and the piping of diverted water. Accordingly, in relation to Alternative B, Alternative C would increase the likelihood of maintaining perennial flow in the approximately 1,600 linear feet of stream channel from 200 East to the Main Street Diversion. This would provide an opportunity to maintain existing riparian/aquatic habitat that could eventually become suitable habitat for southwestern willow flycatcher. Additionally, this alternative would include impacts on an additional 0.3 acres of riparian vegetation along the canals north of the Main Street diversion. This riparian habitat is along a very narrow strip (less than 25 feet wide) along the canals. This habitat is similar to the habitat along Coal Creek in that it is not especially dense or extensive and provides sub-optimal habitat in an already heavily disturbed area.

Impacts to flycatcher habitat from channel modifications and parkway construction under this alternative would be similar to those described under Alternative B.

Yellow-Billed Cuckoo

Impacts to yellow-billed cuckoo from this alternative would be similar to those described for Southwestern willow flycatcher above.

Mexican Spotted Owl (MSO)

The impacts would be similar to those described under Alternative A.

Utah Prairie Dog

The impacts would be similar to those described under Alternative A.

Burrowing Owl

The impacts would be similar to those described under Alternative A.

Ferruginous Hawk

The impacts would be similar to those described under Alternative A.

Fringed Myotis

The impacts would be similar to those described under Alternative A.

Spotted Bat

The impacts would be similar to those described under Alternative A.

Townsend's Big-eared Bat

The impacts would be similar to those described under Alternative A.

3.8.5.1.2 MULE DEER

The project area, according to UDWR, falls within mule deer critical winter habitat south-east of the mouth of Cedar Canyon. Alternative C, both Parkway Options C1 and C2, would cause 9.76 acres of temporary, direct disturbance to the critical winter habitat of the mule deer, slightly less then the disturbances caused under Alternative B. The North Field Canal option would not affect mule deer critical winter habitat.

The noise and increased human activity associated with bank stabilization work that would occur under this alternative may cause a temporary disturbance to mule deer individuals in the area. Impacts would be similar to those described under Alternative B.

3.8.5.1.3 BLACK BEAR

Impacts to black bear habitat under Alternative C (all options) would be similar to those described under Alternative B though slightly less, with 9.76 acres of high-value, yearlong habitat disturbed.

The noise and increased human activity associated with bank stabilization that would occur under this alternative may cause a temporary disturbance to black bear individuals in the area. However, as ideal black bear habitat is more remote, starting at the mouth of Cedar Canyon, there would be no long-term impacts to black bear.

3.8.5.1.4 MOUNTAIN LION (COUGAR)

The impacts would be similar to those described under Alternative B.

3.8.5.1.5 UPLAND GAME

The impacts would be similar to those described under Alternative B.

3.8.5.1.6 Raptors

The impacts would be similar to those described under Alternative B.

3.8.5.1.7 Reptiles, Amphibians, and Other Non-game Species

The construction-related, direct disturbance impacts to these species would be similar to those described under Alternative B, with the following exceptions.

Riparian and Aquatic Species

Alternative C would have fewer long-term, indirect impacts to riparian and amphibian species than Alternative B, but streamflow impacts similar to Alternative A. In relation to Alternative B, Alternative C would increase the likelihood of maintaining perennial flow in the stream channel from 200 East to the Main Street Diversion during the irrigation season, thereby providing perennial riparian/aquatic habitat for non-game species. This in turn would maintain the existing riparian habitat along the stream channel in the middle reach, providing shade and cover for amphibians and helping maintain water quality for invertebrates occupying this stream. Under this alternative, 1,600 more linear feet of existing riparian habitat would be maintained in comparison to Alternative B. Alternative C would maintain the same perennial flow in this 1,600 feet in channel as Alternative A.

Construction and earth-moving activities associated with erosion control modifications and streambank hardening could have direct and indirect, adverse effects on approximately 11,493 linear feet of riparian resources in the project area. Riparian habitat throughout the project area could be crushed, trampled, or uprooted during earth-moving activities in and around the channel, which would mean a temporary reduction in natural erosion control and non-game habitat in the project area. Additionally, approximately 0.3 acres of riparian habitat along the canals north of the Main Street diversion would be impacted by construction and/or moving the water from the canals to a pressurized pipeline. It should be noted that both the spotty riparian habitat found within the 11,493 linear feet of proposed disturbance areas along Coal Creek and the 0.3 acres of riparian habitat along the canals north of the Main Street diversion are of generally poor quality and are found in a heavily disturbed area.

Parkway construction and the planting of native and non-native vegetation in the project area could have direct and indirect, adverse and beneficial effects on existing riparian resources. Direct, adverse effects include the crushing, trampling, or removal of riparian vegetation along the banks during earth-moving activities and parkway installation, which would mean a possible permanent reduction in non-game habitat in the project area. Direct, beneficial effects would include a restoration of riparian vegetation, due to revegetation. This could increase the erosion control potential, as well as permanently improve and expand the existing suitable and potentially suitable non-game habitat and instream shade along the upper and middle reaches of the stream.

Migratory Birds

Modifying the Main Street Diversion would disturb migratory birds in a manner and magnitude similar to Alternative B. However, the maintenance of instream flows in the middle reach of Coal Creek would support the existing riparian habitat in the reach that provides some roosting, nesting, and refuge habitat for neo-tropical migratory birds.

Parkway construction and the planting of native and non-native vegetation in the project area would have impacts on existing riparian habitat—and thus migratory birds—similar to Alternative B. These activities would increase the erosion control potential, as well as improve and expand the existing suitable and potentially suitable migratory bird habitat and instream shade.

3.8.5.2 Mitigation

Mitigation measures would include the following:

1. Raptor surveys should be conducted before construction begins.
2. If active nests are found, spatial and temporal buffers should be placed around the active nests, according to the guidelines laid out in Romin and Muck (Romin and Muck 1999).
3. Avoid, whenever possible, disturbing or removing existing cottonwood, willow, and other native riparian vegetation occurring along the stream.
4. Wherever possible, trees will be planted along the reconstructed stream channel to maintain potential roosting sites for bald eagle, as well as nesting sites for neo-tropical migrants.
5. Roost platforms for bald eagles would be constructed in areas where documented bald eagle roosting occurs and trees will be removed because of proposed stabilization.
6. Surveys for nesting neo-tropical migrants will be conducted prior to construction.
7. If active neo-tropical migrant nests are found, construction would be avoided within 1,000 feet of the active nests during the nesting season.

3.9 Cultural Resources

Section 106 of the National Historic Preservation Act of 1966 (as amended; NHPA), its implementing regulation (36 CFR § 800), and the NEPA collectively mandate the consideration of potential impacts to historic properties resulting from a project with any federal nexus (e.g., permitting, funding, etc.). 36 CFR § 800.8(a)(3) requires the lead agency to complete "appropriate scoping, identification of historic properties, assessment of effects upon them, and consultation leading to resolution of any adverse effects" when preparing an EIS. Historic properties are defined as any prehistoric or historic district, site, building, structure, or object either listed on, or eligible for listing on, the National Register of Historic Places (NRHP) (36 CFR § 800.16(d)). Section 101(b)(4) of the NEPA mandates federal agencies to use all practicable means to "preserve important historic, cultural, and natural aspects of our national heritage." The term *cultural resource* as used in this document is defined as any artifact, site, or feature resulting from human activity that is at least 50 years old as of 2005.

Cultural resources are known to occupy the Coal Creek Parkway Area of Potential Effect (APE). The APE is defined in 36 CFR § 800.16(d) as "the geographic area or areas within which an undertaking may directly or indirectly cause alterations in the character or use of historic properties." The APE for the Coal Creek Parkway project has been identified as the area up to 100 feet beyond the upper bank or terrace of the Coal Creek channel. It is proposed that ground-disturbing work required for implementation of any of the alternatives presented here would occur within this area. The implementation of any alternative may result in impacts to cultural resources, and such impacts to cultural resources must be considered in the process of selecting an alternative.

3.9.1 Existing Conditions

3.9.1.1 Cultural Resource Sites and Historic Properties

In order to identify cultural resources that are present within the Coal Creek Parkway APE and to assess the potential impacts of the project alternatives on these properties, intensive-level pedestrian cultural resources inventories were conducted within the majority of the APE (Christensen et al. 2005; Tews and Stokes 2006). An additional assessment that did not require field inspection was also conducted (Ellis 2006). These inventories and assessment resulted in the identification of 19 cultural resource sites that are located within the APE (Table 3.14).

Table 3.14. Cultural Resource Sites in the Coal Creek Parkway Area of Potential Effect (APE)

Site Number	Site Type	Site Name	NRHP Site Eligibility
N/A	Truss Bridge	200 South Pedestrian Bridge / UDOT Structure Number 021013C	Eligible
N/A	Iron Mill	Pioneer Iron Works Utah State Historic Site	Eligible
42IN1221	Historical Flour and Plaster Mill	Cedar Co-op Flour Mill/ Plaster Mill	Not Eligible
42IN1224	Historic CCC Water Control Feature (South Fields Diversion)	N/A	Eligible
42IN1225	Historical Power Plant	SUP Power Plant	Not Eligible

Table 3.14. Cultural Resource Sites in the Coal Creek Parkway Area of Potential Effect (APE), continued

Site Number	Site Type	Site Name	NRHP Site Eligibility
42IN1226	Historic CCC Water Control Feature (UP&L drop structure)	N/A	Eligible
42IN2273	Prehistoric Lithic Scatter	N/A	Not Eligible
42IN2274	Historical USGS Gauging Station	N/A	Not Eligible
42IN2275	Historic Irrigation Diversion Structure	Main Street Diversion	Eligible
42IN2276	Historical Trash Scatter	N/A	Not Eligible
42IN2277	Historic Farmstead	N/A	Eligible
42IN2278	Historical Water Control Feature	N/A	Not Eligible
42IN2279	Historical Bridge	N/A	Not Eligible
42IN2280	Historical Stream Diversion Structure	Woodbury Diversion	Not Eligible
42IN2281	Historical Irrigation Canal	Old Fort/Old Field Canal	Not Eligible
42IN2282	Historic Irrigation Canal	North West Field Canal	Eligible
42IN2283	Historic Irrigation Canal	North Field/East Extension Canal	Eligible
42IN2284	Historic Irrigation Canal	Union Field Canal	Eligible
42IN2285	Historic Bridge	Main Street Bridge/UDOT Structure Number OD546	Eligible

Each of the cultural resource sites known to occupy the Coal Creek Parkway APE was evaluated as either eligible or not eligible for listing on the NRHP in accordance with 36 CFR § 60.4, using the following criteria:

A. Properties that are associated with events that have made a significant contribution to the broad patterns of our history; or

B. Sites that are associated with the lives of persons significant in our past; or

C. Sites that embody the distinctive characteristics of a type, period, or method of construction that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction; or

D. Sites that have yielded or may be likely to yield information important in prehistory or history.

Using the above criteria, 10 of the 19 identified sites are eligible for listing on the NRHP (see Table 3.14). These historic properties can be summarized by type (in no particular order):

- Water control features
- Archaeological sites that possess boundaries
- Bridges
- Historic sites that posses only integrity of location
- Components of irrigation networks

Each of these historic property types could be impacted by the project in different ways.

Sites 42IN1224 and 42IN1226 are Civilian Conservation Corps (CCC) water control features that span the Coal Creek channel near the eastern end of the APE. The primary stone masonry structures, as well as the earth-and-rock berms that extend laterally from these structures, are elements of these sites that contribute to their ability to convey elements of design characteristic of the CCC. Site 42IN1224 also possesses a modern channel that extends off the south margin of the masonry water control feature and flows west, meandering into and out of the APE. This sluice channel is a modern feature of post-1960s construction that does not convey the associations that contributed to Site 42IN1224's recognition as a historic property. Although the sluice channel does not detract from the ability of this site to convey its association with the CCC, its presence is not an element that contributes to the eligibility of this site for listing on the NRHP. Therefore, impacts to this sluice channel would not diminish the ability of Site 42IN1224 to convey its association with historic events and entities. The two CCC water control features would be most susceptible to direct, physical impacts to their stone masonry and earthen berm construction.

The flood season of 2005 resulted in damage to Site 42IN1226. These impacts occurred following the intensive-level cultural resource inventory for the Coal Creek Parkway Project, a survey that documented existing conditions at the time of data collection (Christensen et al. 2005). These natural, geologic impacts were identified by Cedar City representatives after floodwaters receded, during alternatives analysis. If not stabilized in a historically sensitive manner, failure of elements of this historic property will likely result in the gradual destruction of Site 42IN1226 to such an extent that it may not convey its eligibility for listing on the NRHP.

Site 42IN2277 is a historic farmstead that is located along the west bank of Coal Creek within a residential neighborhood of Cedar City. This farmstead survives in an archaeological context, and possesses one barn, one corral complex, and the foundation of one house. The four-square footprint of this house suggests that it was constructed in the 1890s and is the primary source of historical association for this property. The barn and the corral contribute to this site's association with the agricultural history of Cedar City. No artifacts or other archaeological remains were identified at this site. This site would be most susceptible to impacts such as the stockpiling of dredged material within the site boundaries.

One steel truss bridge (UDOT Structure Number 021013C) and one cast concrete bridge (Site 42IN2285), both possessing a high degree of historical integrity, span the Coal Creek channel. These two bridges are elements of the general historical landscape of Cedar City. They would be most susceptible to direct, physical impacts or modifications to their physical components, understructure, or elements of construction.

The Pioneer Iron Works Utah State Historic Site is the 1852 location of the first steel mill west of the Mississippi River. Located in a residential neighborhood of Cedar City along the west bank of Coal Creek, this Utah State Historic Site retains integrity of physical location. No designed elements of the site remain, and no evidence of archaeological deposits appears to be present. This site has been memorialized as a park and possesses some limited interpretive signage that conveys the history of the site to visitors. This site would be most susceptible to impacts that would diminish the property's interpretive value; on the other hand, interpretive value may be enhanced through the expansion of historical information that is provided for visitors.

Site 42IN2275, referred to throughout this document as the Main Street Diversion, is a historic irrigation diversion feature that spans the Coal Creek channel; it and three of the four irrigation canals that head from this structure are eligible for listing on the NRHP. The eligible canals are Site 42IN2282 (North West Fields Canal), Site 42IN2283 (North Field/ East Extension Canal), and Site 42IN2284 (Union Field Canal). Collectively, these features convey the feeling of historical irrigation technologies that have been employed since the settlement of Cedar City. Sites of this type would be most susceptible to impacts to their historical location, alignment, or elements of physical construction or design that would detract from their feeling as parts of an open flood irrigation network.

No additional historic properties have been identified within the APE. Additional cultural resource sites, isolated artifacts, and features that do not meet the criteria to be recognized as historic properties occupy the APE (Christensen et al. 2005). NRHP criteria have been used to determine which cultural resources qualify as "important historic, cultural, and natural aspects of our national heritage" (Section 101(a)(4) of NEPA). This document will only consider potential impacts to these resources as required by NEPA.

3.9.1.2 NATIVE AMERICAN CONSULTATION

Also pursuant to Section 106 of NHPA and the regulations of NEPA, consultation with Native American groups, the appropriate State Historic Preservation Officer (SHPO), and other interested parties must be undertaken to assess the concerns of these groups in relation to any project with a federal nexus. A cultural resources report has been written to aid this consultation process. As of the publication of this Final EIS, consultation regarding the Proposed Action is currently in progress between the NRCS and the Utah SHPO (see Appendix B for consultation initiation letters).

In addition to the SHPO, the NRCS has consulted with Native American groups in order to assess any heritage concerns these groups may have in relation to the Coal Creek Parkway project and to identify any Traditional Cultural Property (TCP) or sacred site present within the cultural resources study area that could be impacted by the project. Listed in alphabetical order, the Native American groups consulted by the NRCS are:

- Cedar Band of Paiutes
- Hopi Tribe
- Navajo Nation
- Northern Ute Tribe
- Paiute Indian Tribe of Utah
- Shivwits Band of Paiutes

At the time of the release of this EIS, consultation with Native American groups is ongoing. To-date, no TCPs or sacred sites have been identified as a result of consultation (see Appendix B).

Additional consultation with specific tribal governments or offices may be required in the event of special circumstances that might occur during construction or implementation. In the event of a construction discovery, it is NRCS policy that the construction stop immediately and that the discovered resource be protected until the appropriate consultations and determinations have been made. Whenever human remains are discovered within Iron County, contact must be made immediately with the Iron County Sheriff's Department in order to maintain compliance with state law. In instances when Native American human remains are discovered, immediate contact must be made with the Utah SHPO as part of the legal process for determining the patrimonial association of that individual with a Federally Recognized Tribe. The standards of the Native American Graves Protection and Repatriation Act must be observed in all such discoveries. The NRCS is ultimately responsible for maintaining compliance with cultural resource regulations over the course of the proposed undertaking.

3.9.2 INDICATORS

Impacts to the cultural resource sites present in the Coal Creek Parkway APE could result from the selection of any one of the alternatives. Impacts to historic properties must be identified in the process of selecting an alternative. Each historic property that is present in the APE possesses a level of integrity that conveys a degree of association with persons, events, a period, a method of construction, or design values. These characteristics are the primary currency used to evaluate the historical significance of the cultural resources that occupy the APE. Generally, changes in any individual historic property's integrity would indicate an impact. Specifically:

- No impact would be indicated by the absence of changes in the given historic property's ability to convey the historical associations for which it has been recognized.
- An impact to a historic property would occur when the implementation of an alternative would result in changes that would reduce the property's ability to convey the historical associations for which it has been recognized.
- Impacts would also result from those situations where the implementation of an alternative would enhance the ability of a historic property to convey its recognized historical associations.

3.9.3 ENVIRONMENTAL CONSEQUENCES OF ALTERNATIVE A: NO ACTION

The No Action Alternative includes continued dredging of the Coal Creek channel, when and where necessary. No erosion control, streambank hardening, cultural resource site stabilization, or parkway improvements would be conducted under the No Action Alternative.

3.9.3.1 DIRECT AND INDIRECT EFFECTS

Existing conditions may change as a result of the ongoing practice of needs-based dredging in Coal Creek. The placement of dredged materials into the site boundaries of a historic property within the Coal Creek Parkway APE could result in an impact to that property. If the dredged materials produced as a result of the No Action Alternative were placed away from the boundaries of historic properties, then no impact to historic properties as a result of fill placement would result.

Site 42IN2277 (the historic farmstead) and the Pioneer Iron Works Utah State Historic Site possess boundaries that should be avoided whenever dredged material needs to be stockpiled along the banks of Coal Creek. The other historic properties that are known to occupy the Coal Creek Parkway APE are less susceptible to the visual and physical impacts of stockpiled dredge material.

The historic truss bridge does not have sufficient capacity to safely pass the 100-year flood. If a 100-year flood event occurred, the bridge could be washed out and/or cause additional flooding in the immediate area because of the channel constriction.

3.9.3.2 MITIGATION

The practicality of avoiding impacts to historic properties must be considered prior to selecting mitigation measures. By avoiding the placement of dredged material within the boundaries of historic properties, no impacts requiring mitigation would exist. Historic properties that could be adversely impacted by the placement of dredged material are Site 42IN2277 (the historic farmstead) and the Pioneer Iron Works Utah State Historic Site. These sites should be avoided during the placement of dredge material along the banks of Coal Creek.

3.9.4 ENVIRONMENTAL CONSEQUENCES OF ALTERNATIVE B: RELOCATE MAIN STREET DIVERSION

Alternative B would involve demolishing Site 42IN2275 (the Main Street Diversion) and replacing it with a new structure of comparable function in the vicinity of 200 East. Approximately 1,600 linear feet of subsurface pipe would deliver diverted water to the existing heads of the four canals presently served by the Main Street Diversion. The flow of these four canals would be delivered along their present alignments via subsurface pipes that would replace a portion of the existing open ditch system currently in place. Of these four canals, three are historic properties: Site 42IN2282 (the North West Field Canal), Site 42IN2283 (the North Field/East Extension Canal), and Site 42IN2284 (the Union Field Canal).

This alternative would also include channel modifications from Center Street to I-15 (subreaches B–E) to provide for flood conveyance, confining the 100-year floodplain to the creek channel. Under this alternative, periodic dredging would continue on an as-needed basis.

This alternative would include the stabilization of Site 42IN2276 (UP&L drop structure). The intent of this effort would be to prevent natural erosion from reducing the ability of this historic property to convey the associations for which it has been recognized as eligible for listing on the NRHP. Under this alternative, the stabilization efforts would be in keeping with the Secretary of Interior's Standards for Rehabilitation, site stabilization, and preservation to ensure no adverse effect to this historic property's integrity and to achieve beneficial effect.

Under Alternative B, the parkway would be extended to Airport Road, on both sides of Coal Creek, where possible. This alternative includes two pedestrian crossing options at Main Street. Parkway Option B1 is a surface crossing at the Main Street Bridge (Site 42IN2285) on the south side of the creek. Parkway Option B2 would route the parkway along surface streets and sidewalks through the Pioneer Iron Works Utah State Historic Site and across Main Street.

3.9.4.1 Direct and Indirect Effects

Under Alternative B, dredging would continue, though at a reduced frequency; this aspect of Alternative B would result in the same effects as those noted under the No Action Alternative. Alternative B would also leave the historic truss bridge in place, which would have identical impacts to this structure as Alternative A (the bridge could be washed out and/or cause additional flooding in the immediate area if it constricted the channel).

Alternative B would require demolition of Site 42IN2275 (Main Street Diversion) and significant physical alteration of three other historic properties: Site 42IN2282 (North West Field Canal); Site 42IN2283 (North Field/East Extension Canal); and Site 42IN2284 (Union Field Canal). These actions would result in the reduction of the physical integrity of four historic properties to such an extent that they would no longer retain sufficient elements of historical design to warrant their eligibility for listing on the NRHP.

Extension of the parkway to Airport Road would require either a surface pedestrian crossing at the Main Street Bridge (Site 42IN2285) (Option B1), or routing the parkway through the Pioneer Iron Works Utah State Historic Site and then across Main Street (Option B2). Routing the parkway through the Pioneer Iron Works Utah State Historic Site would provide opportunity for enhanced public access to and interpretation of this historic property, resulting in beneficial effects.

Stabilization of Site 42IN2276 (UP&L drop structure) as discussed above would prevent natural erosion from destroying this site. The preservation of the design elements for which this site has been determined eligible for listing on the NRHP, while incorporating historical workmanship and materials to achieve a historical feeling, would result in beneficial effects.

3.9.4.2 Mitigation

Continued, but reduced dredging of the Coal Creek channel under Alternative B would require the same degree of avoidance for historic properties as would be required for the implementation of the No Action Alternative.

Direct effects to Site 42IN2275 (Main Street Diversion), Site 42IN2282 (North West Field Canal), Site 42IN2283 (North Field/East Extension Canal), and Site 42IN2284 (Union Field Canal) could not be avoided if Alternative B were selected, and mitigation would be required to ameliorate the impacts to these historic properties. Mitigation that would be appropriate for the loss of these historic properties would primarily consist of detailed documentation of these features, including the compilation of histories for each property as a component of an irrigation network. Detailed photographic recordation of each feature of each site and detailed engineering drawings for structural features of Site 42IN2275 (Main Street Diversion) would be appropriate elements of such a documentation strategy.

One possible route for extension of the parkway (Parkway Option B2) would run the trail through the Pioneer Iron Works Utah State Historic Site. This option would allow for enhancement of existing interpretive monuments that relate the history of the Coal Creek drainage and Cedar City to the general public. The expansion of the trail would not result in adverse effects to known historic properties, but it could result in direct, beneficial effects to the Pioneer Iron Works Utah State Historic Site. As part of a collective mitigation strategy, the implementation of expanded heritage interpretive signs along the extended parkway could provide public information about the agricultural and irrigation history of the Coal Creek drainage and of Cedar City. Such signage could be designed to further ameliorate adverse effects to Site 42IN2275 (Main Street Diversion), Site 42IN2282 (North West Field Canal), Site 42IN2283 (North Field/East Extension Canal), and Site 42IN2284 (Union Field Canal).

Implementation of Parkway Option B1 (surface crossing at Main Street Bridge) would neither provide opportunities to expand public interpretation at the Pioneer Iron Works Utah State Historic Site, nor have adverse impacts on historic properties.

Beneficial effects to Site 42IN2276 (UP&L drop structure) would be achieved as a result of historically sensitive stabilization of this site. This component of Alternative B would enhance the historical setting of the APE by preserving a publicly recognized feature of Cedar City's landscape. This in turn would contribute to collective mitigation strategies for impacts to historic properties that would result from the implementation of any action alternative and would further enhance the beneficial results that would be achieved as a result of implementation of Alternative B, Parkway Option B2.

3.9.5 Environmental Consequences of Alternative C: Replace Main Street Diversion

Impacts to cultural resources that would result from the implementation of Alternative C would be identical to those that would result from the implementation of Alternative B. Alternative C involves demolishing Site 42IN2275 (Main Street Diversion) and replacing it with a new structure at its present location. Flow from the newly reconstructed diversion structure to the four canals it would serve would be delivered along the present canal alignments via subsurface pipes that would replace a portion of the existing open ditch system currently in place. Of these four canals, three are historic properties: Site 42IN2282 (North West Field Canal); Site 42IN2283 (North Field/East Extension Canal); and Site 42IN2284 (Union Field Canal). Stabilization of Site 42IN2276 (UP&L drop structure), as noted under Alternative B, would also occur.

Alternative C would involve the demolition or relocation of UDOT Structure Number 021013C (the 200 South Pedestrian Bridge [historic truss bridge]). This historic property would be removed from the APE.

This alternative would also include channel modifications from Center Street to I-15 (subreaches B–E) to provide for flood conveyance, restricting the FEMA 100-year floodplain to dimensions of the creek channel. Under this alternative, periodic (though less frequent) dredging would continue on an as-needed basis.

Under Alternative C, the parkway would be extended to Airport Road, on both sides of Coal Creek, where possible. The two options for pedestrian access across Main Street are:

- Parkway Option C1 – constructing an elevated concrete path under the Main Street Bridge (Site 42IN2285); or
- Parkway Option C2 – installing a subgrade culvert adjacent to the Main Street Bridge (Site 42IN2285).

The North Field Canal option would construct a subgrade pipeline within the canal corridor of Site 42IN2283 (North Field/East Extension Canal) from a point just south of 900 North Street to 1045 North Street.

3.9.5.1 Direct and Indirect Effects

Under Alternative C, dredging would continue, though at a reduced frequency; this aspect of Alternative C would result in the same effects as those noted under the No Action Alternative. Plans to demolish Site 42IN2275 (Main Street Diversion) and reconstruct segments of Site 42IN2282 (North West Field Canal), Site 42IN2283 (North Field/East Extension Canal), and Site 42IN2284 (Union Field Canal) would result in the same effects as those noted for Alternative B. Stabilization of Site 42IN2276 (UP&L drop structure), would also result in the same effects noted under Alternative B.

Under the North Field Canal option under Alternative C, segments of Site 42IN2283 (North Field/East Extension Canal) and Site 42IN2282 (North West Field Canal) would be effectively demolished due to construction of a subgrade pipeline within the canal corridors. Site 42IN2284 (Union Field Canal) would remain intact, though no irrigation water would be diverted down any of the remaining channel segments for all three of these canals.

Demolition or relocation of UDOT Structure Number 021013C (200 South Pedestrian Bridge [historic truss bridge]) would result in this historic property's inability to convey associations for which it has been recognized under the criteria of the NRHP.

Both Parkway Options C1 and C2 for pedestrian access across Main Street would result in modifications to the design elements of the Main Street Bridge (Site 42IN2285) and would likely result in adverse effects to this historic property. Additionally, several hundred feet of Site 42IN2282 (North West Field Canal) would be demolished due to construction of a subgrade pipeline within the canal corridor (see Figure 2.6 in Chapter 2).

3.9.5.2 Mitigation

Continued, but reduced dredging of the Coal Creek channel under Alternative C would require the same degree of avoidance for historic properties as would be required for the implementation of the No Action Alternative. Plans to demolish Site 42IN2275 (Main Street Diversion) and reconstruct segments of 42IN2282 (North West Field Canal), Site 42IN2283 (North Field/East Extension Canal), and Site 42IN2284 (Union Field Canal) would require the same level of mitigation as that noted for Alternative B. The pedestrian access options across Main Street would result in the same obligations for mitigation as noted for Alternative B. The historically sensitive stabilization of Site 42IN2276 (UP&L drop structure) would achieve beneficial effects as noted under Alternative B and would be applied as a mitigation measure to ameliorate other adverse impacts to cultural resources that would result from the implementation of either action alternative.

Direct effects to UDOT Structure Number 021013C (200 South Pedestrian Bridge [historic truss bridge]) could not be avoided if Alternative C were selected. Mitigation that would be appropriate for the loss of this bridge would include detailed documentation of the bridge to standards acceptable for the destruction of such a property, to include detailed photographic documentation and engineering drawings of this bridge.

Any modifications to the Main Street Bridge (Site 42IN2285) would likely result in a reduction of its ability to convey the distinctive types of design for which it has been recognized under the criteria of the NRHP. Mitigation that would be appropriate for impacts to this historic bridge would include detailed photographic documentation and engineering drawings of the bridge.

3.10 Recreation and Visual Resources

3.10.1 Existing Conditions

3.10.1.1 Overview

Recreation and tourism have become two of Utah's largest economic sectors. In 2003, over 17 million domestic and international travelers visited the state, spending an estimated $4.3 billion. Approximately 2 million of these visitors traveled through Iron County in 2003 (Cedar City 2005a). Businesses supporting these visitors accounted for over 100,000 jobs statewide, or roughly 10% of all non-agricultural jobs in the state.

Cedar City and its surrounding area have played a major role in attracting visitors to Utah. With an average of 310 days of clear skies per year and an average annual temperature of 50.5°F, and surrounded by Zion and Bryce Canyon National Parks, Cedar Breaks National Monument, and many other natural attractions, the area offers unparalleled natural and aesthetic beauty, earning Cedar City its nickname of the "Gateway to the Parks." The unique visual and recreational resources of the lands surrounding the City provide a variety of opportunities, such as hiking, wildlife viewing, climbing, mountain biking, fishing, and various other activities, for millions of people each year (Cedar City 2005a; Table 3.15).

Table 3.15. Regional Visitation Counts in 2003

Park/Monument	Visitors
Zion National Park	2,480,690
Bryce Canyon National Park	1,375,115
Grand Staircase-Escalante National Monument	670,000
Quail Creek State Park	663,390
Cedar Breaks National Monument	605,930
Snow Canyon State Park	347,804
Kolob Canyons	189,228
Brian Head Ski Resort	145,000
Iron Mission State Park	18,882
Total	6,496,039

Source: Cedar City-Brian Head Tourism & Convention Bureau.

The recent economic recession and the terrorist attacks of 2001 have dampened both international and domestic tourism in the area. With the exception of Zion National Park, most parks experienced an average reduction in visitation of 12.5% soon after 9/11. However, a recent rebound in the numbers of visitors suggests a return to pre-2001 trends. I-15 traffic counts through this region increased from 6.6 million in 2001 to 7.2 million in 2002, approximately 8% (Cedar City 2005a).

The public lands that surround the City benefit it tremendously, both economically and recreationally, but Cedar City has become a destination area in its own right. The city, becoming known as the "Festival City," is home to the world-renowned Utah Shakespearean Festival, as well as the Utah Summer Games, the Children's Art Festival, Groovefest, the July Jamboree and Car Show, the Fall Arts Festival, and the Children's Christmas Festival.

The Shakespearean Festival, founded in 1961 and winner of the 2000 Tony Award for America's Outstanding Regional Theater, is critically acclaimed throughout the world. It attracts nearly 140,000 visitors a year to the City from all walks of life (Cedar City 2005a; Table 3.16). The Utah Summer Games is another major event hosted by the City, one that draws thousands of athletes of all ages and their families from around the state each summer. In 2002, approximately 9,000 athletes competed in 50 different sporting events, and over 13,000 spectators attended the opening ceremony (Cedar City 2005a).

The winter months bring nearly 145,000 skiers and snowboarders to Brian Head Resort, which is 30 minutes north of Cedar City. *Family Travel Forum* recently selected Brian Head as one of the top 10 getaways for the family due to its affordability and quality year-round entertainment (Cedar City 2005a). Summer months at Brian Head provide opportunities for

Table 3.16. Utah Shakespearean Festival Patron Demographics in 2003

Demographic	% of Total Patronage
Over $50,000/year salary	66%
Post high school education	78%
First time patrons	10%
Utah	49%
Nevada	25%
Idaho/Colorado	4%
California	10%
Arizona	6%
Other States/International	6%

Source: Cedar City 2005a.

world-class mountain biking, OHV riding, hiking, and various other activities. Approximately 65% of the resort's guests arrive via from Las Vegas and Southern California, necessitating the need for accommodation and entertainment in town (Cedar City 2005a).

Cedar City is the cultural center and county seat of Iron County and has the largest population by far (23,838, as of the 2000 Census; U.S. Bureau of Census 2000a), more than double the remaining population within the county. Iron County has many cultural, civic, and commercial facilities for use by its citizens as well as patrons traveling to or through Cedar City. As the population and regional demand increases these amenities will no doubt change in number increase. Although such facilities are spread throughout the county, many are located within Cedar City (Table 3.17).

With the current population growth trend in Cedar City, the demand for diverse recreational opportunities is ever growing. The City's Parks and Recreation Department's (PRD's) mission statement states:

> The Cedar City PRD provides leisure opportunities for all citizens to improve their quality of life as individuals and as a community We focus on enhancing a healthy lifestyle for each participant and provide them with an enjoyable experience while in our community (Cedar City 1999).

The premium that Cedar City and its residents put on recreational amenities is evident in the new Park Discovery. This park is the newest Iron County recreational facility, finished in the fall of 2001. Indicative of the premium the residents put on recreation, Cedar City residents donated 40,000 hours of community service and raised $350,000 to build the park (Cedar City 2005b).

Table 3.17. Cedar City Facilities Commonly Used for Recreation

Facility Type	Number
Equestrian Center	1
Golf	1
Art Galleries	2
ATV Rentals	3
Movie Theaters	3
Libraries	3
Rodeo Grounds	4
Museums	4
Radio Stations	5
Professional/Amateur Theaters	5
Bars/Pubs/Lounges	7
Parks	8
Tennis Courts	10
Ball Fields	12
Eating Establishments	56
Hotel Rooms	1,583

Source: Iron County Tourism and Convention Bureau.

3.10.1.2 Coal Creek Parkway

Historically, Coal Creek has been an important resource for people and wildlife in the region. In addition to irrigation and other uses, the creek offers abundant recreational opportunities to residents and visitors.

Of the 8 parks that the City owns and operates, only the Coal Creek Parkway is categorized as a linear park by the PRD. Linear parks are defined by the PRD as trail systems, with open space or landscaped areas that generally follow a stream corridor, railroad ROW, power line easement, or other elongated feature.

The character of the Coal Creek corridor from the canyon to I-15 is diverse and serves as a visual and recreational centerpiece for the community. The channel has carved steep walls on its way down the canyon to the alluvium upon which Cedar City is built. Sandstone, siltstone, mudstone, and limestone, formed under a variety of conditions, distinguish this varied landscape. The erosive qualities of these rocks and precipitation have, over the millennia, created storied landscapes rich with color, such as Cedar Breaks National Monument.

The Cedar Breaks Scenic Byway (U-148) is 22 miles east of Cedar City. The 6-mile road hosts views of the Escalante Desert and the Great Basin. On a clear day travelers can see as far away as 100 miles. The Byway also takes you past mountain meadows filled with wildflowers in the spring as well as the red rock amphitheater of Cedar Breaks. Though Cedar Breaks is breathtaking, access to the monument via Cedar City and Cedar Canyon is visually stunning in itself.

Coal Creek flows out of the canyon and directly into an urban setting, creating an immediate contrast in the views to and from the existing trail. The existing parkway and trail system runs from the Cedar Baseball Park facility on 200 North, through East and West Canyon Parks, and then up the canyon approximately 2 miles, to terminate at the Southwest Wildlife Foundation property near the UP&L drop structure (Figure 3.10). A 10-foot-wide, paved trail runs parallel to Coal Creek; it accommodates multi-modal uses as well as service in both directions and is furnished with benches and water fountains at regular intervals. The elevation at the beginning of the trail is 5,810 feet and it gains approximately 230 feet over 2 miles, as it follows the creek up the canyon to an elevation of 6,046 feet. This gentle slope makes the trail accessible to most individuals. The natural environment in the canyon provides cool shade in the summer, as well as opportunities for nature viewing; running, hiking, biking, and other recreational pursuits; and educational opportunities; for example, the trail takes pedestrians past 2 historical CCC structures whose histories are integral to the development of the City (see Section 3.9, Cultural Resources). Data as to the exact number of people who use Coal Creek Parkway is unavailable. However, people in the community use the trail for a variety of purposes. These uses include but are not limited to walking, hiking, biking running, dog walking, and roller blading. The trail is not designated for equestrian or OHV use.

Several man-made structures have changed the course and quality of the stream, impacting the natural character of the corridor. For most of the year, natural flows are minimal, supplying the creek with just enough water to cover the bottom of the channel. Spring snowmelt and summer storm events cause higher flows and more visual interest. However, high levels of suspended sediment and subsequent turbidity accompany the higher flow events.

East and West Canyon Parks border the trail at the mouth of the canyon. Together, the parks amount to approximately 10 acres of open space used for sports and various family activities. Both have full amenities such as lighting, bathrooms, covered pavilions, barbecue grills, volleyball courts, benches, and horseshoe pits. Trail access points are located at the Cedar Park baseball/softball facility and West Canyon Park. The trailheads are supplied with adequate parking as well as handicap access, and additional areas for parking are located up Cedar Canyon Road on the opposite side of the stream from the trail. The primary access points are located only at the mouth of the canyon within Cedar and West Parks.

The Cedar City baseball/softball facility located near 200 East is another important recreation locale on the existing parkway in Cedar City. The park provides 6 baseball/softball fields for varying skills/ages, as well as 2 recreation sites: one for the Highland Drive

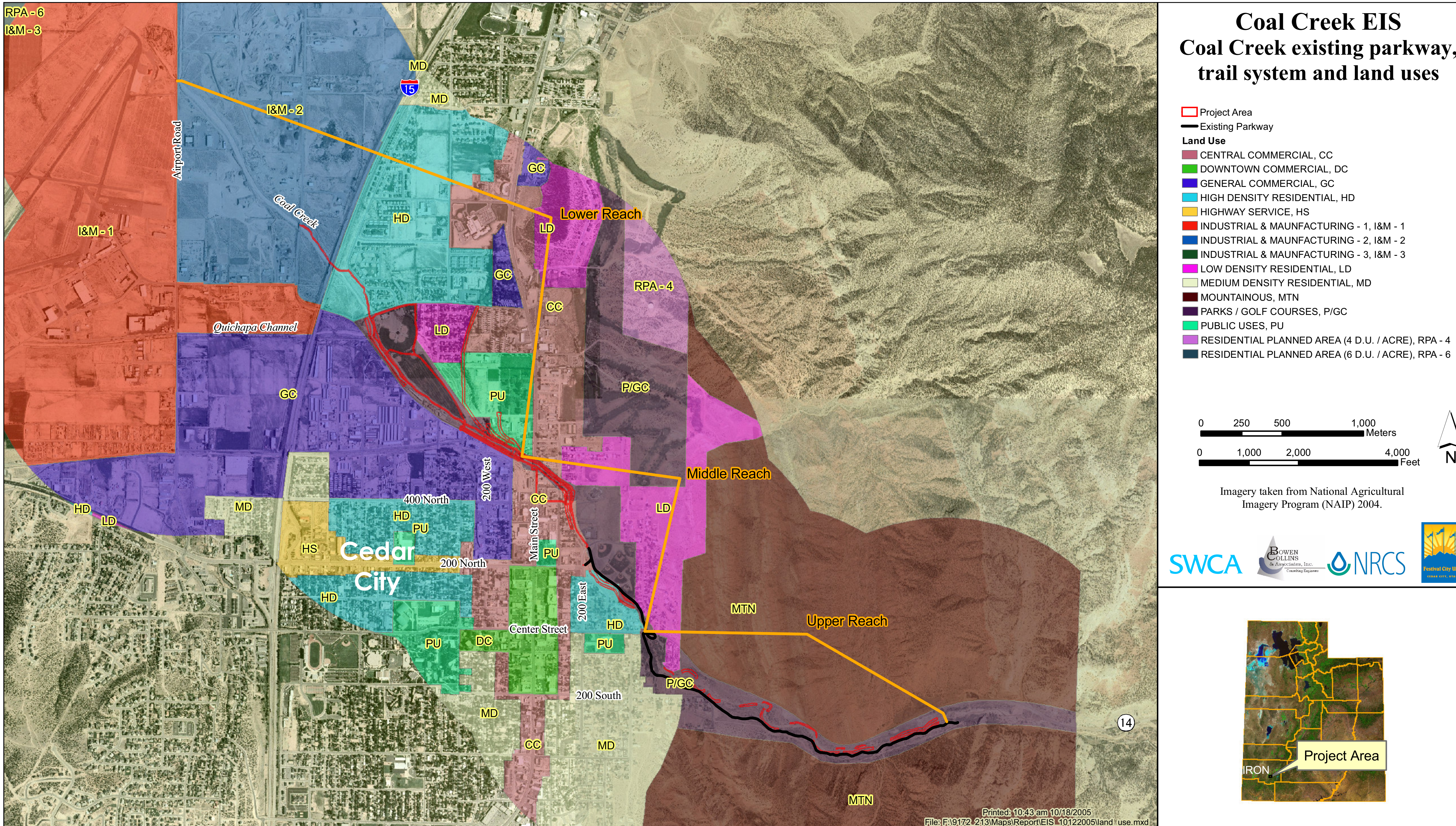

Figure 3.10. Coal Creek existing parkway, trail system and land uses.

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Neighborhood and one for the 300 East Neighborhood. The complex is an asset to the surrounding residences as well as to the City as a whole. As the stream flows westward, it flows through residential neighborhoods and borders the headquarters for the Paiute Native American Reservation Headquarters before coming to the Main Street Bridge. Here land uses change to commercial. The commercial areas, particularly from 200 East to Main Street and immediately to the west, have low visual appeal. Around the Main Street Bridge, the stream has been widened and dredged to prepare for the expected runoff from the record year of winter precipitation in 2005. Approximately 1,900 cfs was later observed in the channel as a result of the high runoff.

As the creek approaches I-15, it is bordered on the north by open space, much of it owned by Cedar City and operated as the Bicentennial Softball Park. The park contains a large softball complex and other amenities. Directly west of the park, a new subdivision is under construction. West of I-15 to airport road, the land use is primarily agricultural with industrial operations north of the corridor.

The City's planning goal is 3.5 acres of parkland (any type of park, e.g., neighborhood, community, etc.) per 1,000 residents (Cedar City 1999). As of the approval of the Cedar City Parks and Recreation Plan, the City had approximately 2.94 acres of developed parkland per 1,000 people (Cedar City 1999). This number has changed and is to be updated at some point this year (Personal communication with Bob Tate, Cedar City Parks and Recreation 2005).

Studies of pedestrian behavior have shown that a majority of pedestrians would walk to a destination within 15 minutes or less, but the numbers drop significantly as distances and/or times increase (Leavitt 2002). Therefore, hypothetically speaking, the number of people living within a 15-minute walk (approximately 0.75 miles) of the parkway trail would be a major factor in how much the trail is used. There are currently 832 existing residential parcels within a 0.75-mile radius of the existing parkway. Based on Iron County's average household size (3.1 persons per household) the number of people within a 15-minute walk of the trail is more than 2,500. This is a conservative estimate, as individuals living farther away would have still have 15-minute access via bicycle or other modes of transport (e.g., equestrian).

3.10.2 INDICATORS

The primary indicators for determining effects to recreational and visual resources along the Coal Creek Parkway include the total amount of parkland available to residents, user accessibility, and amount and type of visual contrast within the existing creek corridor.

- Impacts to the amount of parkland available would be measured by the acres of parkland per 1,000 residents.
- Impacts to accessibility would be assessed by the number of total trailheads or access points to the parkway trail system and the number of residentially zoned parcels within a 0.75-mile radius of the parkway.

- Visual impacts would be qualitatively assessed as the amount of visual contrast from the existing form, line, color, and texture of the existing creek channel corridor.

3.10.3 Environmental Consequences of Alternative A: No Action

The No Action Alternative would maintain existing conditions and continue current management practices. It would include continued dredging in the channel when and where necessary, no additional on-site construction equipment, and no additional erosion control, streambank hardening, or parkway improvements.

3.10.3.1 Direct and Indirect Effects

The direct and indirect effects of the No Action Alternative on recreation would be minimal. The city's current recreational opportunities would continue. However, without flood control, the number of days available per year for trail use could be impacted due to major flood events. Flooding along the trail may create a hazardous situation to pedestrians and may damage the existing trail or impact the aesthetic attributes of the current trail corridor.

The direct and indirect effects of the No Action Alternative on visual resources would be minimal as well.

3.10.3.2 Mitigation

Mitigation measures should include scheduling dredging activities at periods of low flow to minimize the risk of flood events, appropriate storage of dredged material to minimize the visual impacts during major storm events, timely reseeding/revegetation of affected locations along the current trail corridor and adequate measures to ensure a safe, fun, visually pleasing trail for all of the citizens of Cedar City. As dredging and erosion control projects take place, closing the trail may be necessary to protect users from hazardous areas. Postings at access locations should warn users of current and pending projects. Dredged materials and maintenance areas may also be screened by vegetation to minimize the potential visual impacts of such projects.

3.10.4 Environmental Consequences of Alternative B: Relocate Main Street Diversion

Alternative B proposes removing the Main Street Diversion and rebuilding it approximately 1,600 feet further east of its current location, near 200 East. Implementation of this alternative would require approximately 3,250 feet of pipeline to be installed, flood- and slope/grading-related channel modifications from Center Street to I-15, and the continuation of periodic dredging as necessary. To ensure continuity and access, the parkway system would allow for pedestrian access by way of a surface road crossing across Main Street. Currently, there are 2 options to facilitate the crossing:

- Parkway Option B1 – Develop/Enhance a crosswalk at the Main Street Bridge to connect the parkway trail. This option would potentially require property or easement acquisition.
- Parkway Option B2 – Develop/Enhance the trail using existing sidewalks and ROWs. The trail would cross to the south side of the creek at the proposed 400 North pedestrian bridge. The route would then go north along the east side of Main Street to the Coal Creek crossing and use street crosswalk to access the trail on the west side of Main Street. This option would not require property or easement acquisition.

3.10.4.1 Direct and Indirect Effects

The effects on the recreational experience and opportunities under Alternative B would create direct and indirect benefits as well as adverse effects.

Alternative B would lengthen the current parkway trail from 2 miles to approximately 5.5 miles. This alternative would also extend the parkway corridor from the 200 East baseball/softball facility to Airport Road, resulting in an estimated 8.3 additional acres of parkland available, addressing the need for additional park space acreage per 1,000 persons. As a result of implementation of Alternative B, the parkway trail would connect Coal Creek Canyon with four of Cedar City's largest parks (East Canyon Park, West Canyon Park, Cedar Park, and the Sports Complex near I-15), creating a number of new recreational opportunities. The extension would also offer citizens a safe alternative for commuting from the east side of Cedar City to Airport Road west of I-15.

Landscaping would be included with the new segment of the trail, enhancing the visual and overall recreational experience.

The lengthened trail in Parkway Option B2 would also take users past the Old Iron Mill site. The Iron Mill, built in 1852, is registered on the State and National Registers of Historic Places (see Section 3.9, Cultural Resources, for further detail) and played an important role in the settling of Cedar City and the region. Although no historic structures remain, a park and 3 associated plaques remind citizens and visitors of the history of Cedar City and the historic importance of the site.

The improved parkway would be accessible to an additional 1,335 people within walking distance (0.75 miles) of the trail, bringing the total to approximately 3,831 people. The extension of the trail will also improve access and attract bicyclists and various other recreational uses from around the city. The improved parkway trail would also increase pedestrian traffic to and from businesses, as the trail passes through commercial and industrial areas—an indirect, beneficial effect of Alternative B.

As a result of the increased number of people and business in and around the trail corridor, the number of users would increase (see Appendix D, Benefits to Recreation Use). This increase may have beneficial as well as negative effects on people's recreational experience along the corridor. On one hand, the trail would be an excellent medium for social gatherings and crossing paths with a diverse population of city residents. On the other hand, however, as the parkway trail becomes more crowded, issues between the types of users may arise. Although such issues are usually between motorized and non-motorized uses, there would be potential for conflicts between walkers and bikers, for example.

Periodic dredging of sediment from Coal Creek may impact the aesthetic appeal of the trail as well. It may also impact the number of days the trail may be used in a given year. As erosion and flood control measures are addressed, segments of the trail may be shut down due to the hazards of depositing and removing large mounds of dredged materials. The removed material would also temporarily impact the visual characteristics of the trail, as mounds would be placed nearby while they await removal. The turbidity of the creek may also increase during construction of the parkway and while periodic dredging occurs. Landscaping would be included with the new segment of the trail, enhancing the visual quality and overall recreational experience.

As mentioned above, Parkway Option B1 under this alternative includes a surface road crossing or crosswalk at the Main Street Bridge to connect the trail from the east and west sides of Main Street. Although connectivity of the trail system would be ensured under this Option, several potential impacts would occur. The inconsistency of a nature trail and the proposed crosswalk would impact the aesthetic value; visual and user experience as the trail takes the user from the creek corridor to the urbanized and heavily traveled Main Street. Pedestrian crossings present risks as one attempts to cross a heavily used road. These risks could be reduced via a signaling system at this crossing.

Under Parkway Option B2, the trail would leave the Coal Creek corridor and travel west on 400 North, before traversing north along the east side of Main Street and then crossing at a crosswalk on the south side of the Main Street Bridge. The quality of the recreational and visual experience may be compromised as the trail moves from the Coal Creek corridor down 400 North, before traversing north to the proposed Main Street Bridge pedestrian crossing. Visually, the trail would move from a vegetated pathway along Coal Creek to an urban environment, which includes residential, commercial and governmental uses. Car-collision risks to trail users or pedestrians would be increased as the trail directs users through an urbanized environment along 400 North and Main Street before crossing and connecting with the trail.

Recreation facilities provide benefits to the local and tourist population that are more qualitative in nature. Recognizing the difficulty in assessing these types of benefits, the NRCS outlines a "Unit Day Value Method" in its Water Resources Handbook for Economics. The approach relies on expert judgment to evaluate the willingness of citizens to pay for recreation activities. Surveys were provided to several agencies in the Cedar City area, requesting information regarding the anticipated recreation experience at Coal Creek, with the parkway added, in comparison to other recreation sites in the area. (See Appendix D for further detail on survey and analysis). Based on an increased usage of 350 visitors per day (roughly double the current visitation) with parkway improvements (Cedar City Parks and

Recreation 2005), and an average day user value of $6.78, parkway improvements would result in benefits of $866,145 annually. Parkway Options B1 and B2 are similar in overall cost and are slightly less than Alternative C (see Section 3.12 for details).

3.10.4.2 Mitigation

As the popularity of the trail and the number of users grow, certain measures may be needed to preserve the recreational and visual amenities of the parkway. Addressing trail etiquette, posting trail rules and having means to enforce those rules may be necessary. This would preserve the recreational experience and safety of all users, while also protecting wildlife and vegetation found along the trail.

Landscaping would be included with the new segment of the trail, enhancing the visual and overall recreational experience. However, unmitigated, off-trail travel may impact the quality and longevity of plant life along the trail, thus degrading the natural and visual value that it offers. Adequate lighting along the trail would also be recommended as an added safety and security measure.

As dredging and erosion control projects take place, closing of segments of the trail may be necessary to protect users from hazardous areas. Postings at access locations should warn users of current and pending projects. Dredged materials and maintenance areas may also be screened by vegetation to minimize the potential visual impacts of such projects.

Access to the trail should be made available in several locations to disperse users throughout the trail corridor. By doing so, the entire trail would be utilized, minimizing user conflicts and creating opportunity for peace or reflection.

3.10.5 Environmental Consequences of Alternative C: Replace Main Street Diversion

Alternative C proposes to demolish the current Main Street Diversion and construct a new diversion that eliminates approximately half the vertical drop (up to 8 feet) of the irrigation diversion/drop structure currently in use. Implementation of this alternative would require approximately 3,000 feet of pipeline to be installed, flood- and slope/grading-related channel modifications from Center Street to west of I-15, and the continuation of periodic dredging as necessary. The North Field Canal option proposes to use one pipe instead of three pipes to convey irrigation water from the sediment basin to the existing irrigation system.

Under this alternative, access across Main Street would be facilitated via construction of an underpass on the north side of the creek at the Main Street Bridge. Two parkway options are currently being studied:

- Parkway Option C1 – Construct a concrete path under the Main Street Bridge that would be elevated several feet above the channel invert. This parkway option would potentially require property or easement acquisition on the north side of the channel.
- Parkway Option C2 – Construct a large box culvert parallel to the creek and adjacent to the Main Street Bridge that would be dedicated for pedestrian use. The parkway option would likely require property or easement acquisition.

3.10.5.1 DIRECT AND INDIRECT EFFECTS

Effects on recreation for Alternative C are essentially the same as they are for Alternative B. However, differences between the two alternatives primarily regard the two parkway options, which are different under Alternative C. As mentioned above, options under Alternative B promote connectivity through the use of crosswalks at a surface level, whereas both options under Alternative C include an underpass under the Main Street Bridge.

The use of an underpass would satisfy the need for connectivity of the trail to both sides of Main Street, while allowing for a safe and unobstructed trail throughout the entire parkway. The underpass would negate the need for any deviation from the trail or the need for cross walks across Main Street, creating a safe environment for trail users away from heavy traffic flow. If water from large flood events posed a hazard for pedestrians, the walkway under the bridge would be closed. As hazards are reduced, the quality of the trail would increase, enhancing the overall recreational experience.

In regards to visual impacts, Parkway Option C2 proposes a box culvert for the trail as it passes under the Main Street Bridge. A box culvert would block all views of the creek and the surrounding bridge and vegetation as users pass through it. Parkway Option C1 would allow views to continue unobstructed as users pass under the bridge.

Additionally, it should be noted that Alternative C would use the Coal Creek channel to convey irrigation water from 200 East to the replaced Main Street Diversion. This would increase the likelihood of perennial flow in the section of the stream channel near Main Street throughout the year. This perennial flow would contribute to the aesthetic beauty of the parkway, thereby increasing the positive recreational experience of parkway users.

Alternative C has slightly higher overall costs than Alternative B, as Alternative C includes the removal of the historic pedestrian bridge as well as the more expensive construction of a pedestrian crossing under Main Street (for both Parkway Options).

There would be no impacts to recreation or visual resources associated with the North Field Canal option.

3.10.5.2 MITIGATION

Proposed mitigation measures for Alternative C would be the same as those measures found under Alternative B.

3.11 Socioeconomics and Environmental Justice

Socioeconomics typically can be discussed in terms of the social setting, the economic setting, and the relationship between the two. A social and economic analysis traditionally involves gathering relevant and available data to prepare a report describing the socioeconomic characteristics of a given area. Environmental justice, the fair and ethical treatment of all race, color, national origin or income, in regards to development, implementation and interpretation of environmental laws, regulations, etc. (EPA 2005d), is also included in this study. According to Executive Order 12898, all federal actions will address potential disproportionate impacts to low-income or minority populations.

3.11.1 Existing Conditions

3.11.1.1 Historical and Social Setting

Cedar City was named by early settlers because of the abundance of cedar (juniper) trees in the area. The city was originally called Little Muddy for the creek where the town was first established. Pioneers arrived on November 11, 1851, and soon set up the first iron refinery west of the Mississippi, using ore from the hills to the west, coal from nearby Cedar Canyon, and water from Coal Creek for energy.

As the third-fastest growing city in the state (Cedar City 2005a), Cedar City has grown from its small-town, agricultural and mining roots to become a city of approximately 24,000 (Sonoran Institute 2005), with a variety of employment and recreational opportunities. The City, a short drive to numerous national parks and monuments, is an obvious destination for tourists but is also becoming a choice for manufacturing and industrial firms due to its centralized location to most major cities in the West.

Although it was settled by Mormon pioneers and is still predominantly LDS, the City's population has become more religiously diverse, with a variety of religious congregations now practicing throughout the City. The City is also the headquarters for the Paiute Indian Tribe of Utah, which provides health, social, housing, alcohol and drug, environmental and economic development services to the Tribe.

With an average family size of 3.07 and crime rate much lower than the national average, Cedar City is known for fostering a safe, family atmosphere (Sonoran Institute 2005). As noted in Section 3.10, Recreation and Visual Resources, the citizens of Cedar City place a premium on sports, recreation, and cultural events, and pride themselves on the opportunities offered within the City and the surrounding area. (Sonoran Institute 2005) Although Cedar City's median age is 23.3 years, the city provides recreational and social opportunities for citizens of all ages.

3.11.1.2 Demographic Characteristics

Figure 3.11 shows the trend in Iron County's population. Over the 32-year period from 1970 to 2002, the county's population increased by 23,061 people, or 187%. During this time, population growth in Iron County outpaced that of the state and the nation. Cedar City, as the largest city in Iron County, encompasses 60% of the county's population (Sonoran Institute 2005).

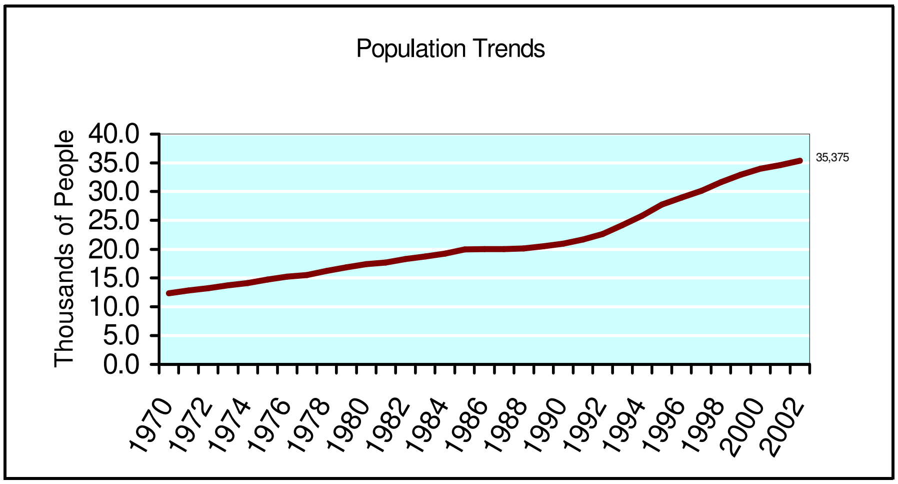

Figure 3.11. Population trend of Iron County, 1970–2002.

As the population in the county has grown, the age of the county inhabitants has generally decreased since 1990. The median age for both the county and the City are well below the national median age of 35.3 years and the Utah median age of 27.1. Although the overall population increased across all categories according to the U.S. Census, the youth population (under 20 years) declined in percentage terms (4%) compared to the 1990 Census, as did the retirement age population (1%) (Table 3.18; Sonoran Institute 2005).

The ethnicity of Cedar City is fairly homogenous. More than 90% of City residents are white. The Hispanic ethnicity comprises only 4% of the remaining population. As might be expected in a city so close to numerous Tribal lands, the next largest ethnic group in Cedar City is Native Americans, though only at 2.5% (Table 3.19).

Iron County also has some the highest rates of both high school and college graduation in the nation, with 23.8% of the adult population over the age of 25 having a college education, and 89% of all adults being high school graduates. The numbers for Cedar City are slightly higher, with 28% having a college degree or greater and 91% of all those 25 and older graduated from high school (Table 3.20). Nationally, only 80.4% of adults are high school graduates, while 24% have a bachelors degree or higher. Cedar City's numbers are especially high for a rural area (Cedar City 2005a).

Table 3.18. Population of Cedar City, by Age and Sex, 2000

	% Female / % Male	Female		Male		Total	
Under 20 years	52 / 48	3,837	37%	3,574	36%	7,411	36%
65 years and over	57 / 43	915	9%	694	7%	1,609	8%
Total	51 / 49	10,494	100%	10,033	100%	20,527	100%
Median Age		22.7		23.7		23.3	

Source: Sonoran Institute 2005.

Table 3.19. Total Population by Race

	Population	Percent
White/Caucasian	18,897	92.1%
Hispanic/Latino	841	4.1%
American Indian or Alaska Native	519	2.5%
Asian	227	1.1%
Black/African American	97	0.5%
Native Hawaiian or Other Pacific Islander	67	0.3%
Other race	339	1.7%
Two or more races	381	1.9%

Source: Sonoran Institute 2005.

Table 3.20. Educational Attainment

	Number	Percent
Less than high school	808	9%
High school	1,910	21%
Some college	3,130	34%
Associate degree	822	9%
Bachelor's degree	1,726	19%
Master's degree	577	6%
Professional school degree	118	1%
Doctoral degree	183	2%
Total	9,274	100%

Source: Sonoran Institute 2005.

As of 2000, nearly half of all residents were involved in some level of education attainment. Nearly 25% of Cedar City residents were enrolled in college, graduate school, or a vocational school, 7% were enrolled in high school, and 15% were enrolled in nursery through grade school (Table 3.21; Sonoran Institute 2005).

Table 3.21. School Enrollment, 2000

	Number	Percent
Nursery school, preschool, and Kindergarten	568	3%
Grades 1-8	2,325	12%
High School	1,302	7%
College - Undergrad	4,510	23%
College - Graduate or Professional	213	1%
Not in School	10,314	54%
Total	19,232	100%

Source: Sonoran Institute 2005.

3.11.1.3 Economic Setting

Across the West, once-vibrant economic sectors like agriculture, livestock grazing, mining, and forestry are declining, having a profound socioeconomic and eventually demographic impact on communities. Younger workers have left the more rural areas for improved employment opportunities and higher wages in rapidly growing urban areas. Iron County and Cedar City have not been excluded from these declines.

Iron County has a history rich in extractive-resource industries as well agricultural and grazing uses of its lands. Pioneers arrived in 1851 and were quick to establish the first iron refinery west of the Mississippi, extracting resources from nearby Cedar Canyon and the surrounding mountains. Although mining still continues in Cedar City, the economy has shifted to become more agrarian in nature, with grazing (sheep and cattle) being the primary agricultural use. The City and county did experience a boom in iron production during World Wars I and II. The county became the second wealthiest in the state during the 1950s, as millions of tons of iron ore were shipped to steel plants in northern Utah, California, and Colorado. Mining operations in Iron County endured labor union disputes and the increasing cost of domestic steel through the 1950s and 1960s, but succumbed in the late 1970s, when the price of manufacturing domestic steel could no longer compete with the lower cost of foreign steel (Seegmiller 1998:333-335).

As affordable means of transportation became more available during the 1920s, the transportation infrastructure was steadily improved, with new roads and highways and a Union Pacific railroad spur to Cedar City. After these infrastructure improvements, Cedar City and

Iron County began to see an influx of visitors looking to experience the natural wonders nearby. This was the beginning of the tourism industry in the region, and Cedar City became known as the "Gateway to the Parks."

In contrast to the gradual decline throughout the twentieth century of more traditional, goods/materials-based economic sectors, southern Utah's recreation and tourism industries have only grown, especially in recent years. Tourism now holds the potential to expand and diversify the economic base of many rural communities in southern Utah. Tourism's growth stems from a number of factors:

1. internationally recognized natural, scientific, and scenic resources;
2. significant cultural resources (e.g., archaeological sites from the Fremont and Anasazi cultures to more recent ghost towns and pioneer settlements);
3. a large number of state- and nationally-designated parks and protected areas;
4. accessibility to international tourists via Salt Lake and Las Vegas international airports; and
5. accessibility to domestic tourists from Las Vegas, the West Coast, Arizona, and Utah's own rapidly growing Wasatch Front (Green and Lillieholm 2005).

Travel/tourism has become one of Utah's largest economic sectors. Indeed, in 2003, over 17 million domestic and international travelers visited the state, spending an estimated $4.3 billion. Businesses supporting these visitors accounted for over 100,000 jobs, or roughly 10% of all non-agricultural jobs in the state. A large percentage of these visitors are attracted to Utah's national parks and other areas of scenic beauty. In fact, despite Utah's international reputation as a premier ski destination, visits to the state's national parks in 2003 exceed that of skiing by over 60% (e.g., 5.0 million national park visitors vs. 3.1 million skier visits).

Today Cedar City has a healthy, diverse economy comprising four major sectors: Manufacturing (28%), Retail Trade (28%), Accommodations and Food Services (20%), and Administrative Services and Support (13%). Due to its centralized location to other major markets in the West, its proximity to various regional transportation options (including I-15, the Union Pacific Railroad, and the Cedar City Regional Airport), and the commitment of local government leaders, Cedar City has successfully attracted a diversified manufacturing base (Cedar City 2005a). Today, more than 15 manufacturing firms call Cedar City home, creating products such as plastic molding and aircraft parts. Three industrial parks with easy access to I-15 house a variety of distributors and manufacturers. The centralized location of the City makes it accessible to 86.5% of the Western metropolitan population—within a single day's trucking (Cedar City 2005a).

Southern Utah University (SUU) is located in Cedar City as well. Founded in 1897 as a teacher-training school, SUU is now a four-year university with a variety of undergraduate- and graduate-level curricula providing the higher learning needs for individuals in the region. Today nearly 7,000 students attend the university, with faculty and staff numbering 650.

Cedar City employment and income data are described below.

3.11.1.3.1 EMPLOYMENT

The City's largest employers are in education: SUU and Iron County School District.

Table 3.22 shows employment change, by industry, from 1970 to 2000 in Iron County, including full- and part-time jobs. Total employment throughout this period grew over 27% with 13,869 new jobs added. Expressed on a jobs-per-worker basis, the employment in Iron County is 0.82 jobs per worker. This number is based on the employment age population (15-65 years of age). The college age (20-24 year old) segment of the population, the largest segment in Iron County, may make explain the low jobs-per-worker ratio (Sonoran Institute 2005).

The employment data does not indicate a major shift in sectors. As was the case in 1970, the two largest employment categories as of 2000 were the Services and Professional (59.3%) and Government (19.8%) sectors. The only sector to experience a loss of jobs (based on the data above), was the Farm and Agriculture sector, losing 78 of the 676 total farm jobs in 1970. Data is not available for Agricultural Services and Mining sectors (Sonoran Institute 2005).

In 2000, 19,071 jobs were identified in Iron County. Wage and Salary employment comprised approximately 78% of the market, while Proprietor employment (sole proprietorships, partnerships, and tax exempt cooperatives) comprised 22%. Note that although the total number of employee's increased from 1970, the percentage of Wage and Salary versus Proprietorships remained exactly the same (Sonoran Institute 2005). The increase in proprietorship employment may indicate a spirit of entrepreneurship, but may also indicate a need in the community of second/side jobs in addition to their salary/wage position. These numbers may in fact pull down the average wages within the county.

Cedar City and the surrounding region were vulnerable to the recession that impacted the entire nation beginning in 2001. While the county unemployment rate of 4.2% remained slightly below the national average of 4.3%, the rate did measure higher that the Utah's six-month average of 3.6% (Utah Department of Workforce Services 2001). Trade and Government sectors were the only two major industries that did not experience a downturn during this period. Manufacturing and Construction were not as lucky, as both generated the largest job losses in 2001 (Figure 3.12).

Table 3.22. Employment Changes in Iron County, by Industry, 1970 and 2000

	1970	% of Total	2000	% of Total	New Employment	% of New Employment
Total Employment	5,202		19,071		13,869	
Wage and Salary Employment	4,078	78.4%	14,956	78.4%	10,878	78.4%
Proprietors' Employment	1,124	21.6%	4,115	21.6%	2,991	21.6%
Farm and Agricultural Services	713	13.7%	N/A	N/A	N/A	N/A
Farm	676	13.0%	598	3.1%	-78	NA
Agricultural Services [1]	37	0.7%	N/A	N/A	N/A	N/A
Mining	282	5.4%	N/A	N/A	N/A	N/A
Manufacturing [2]	327	6.3%	1,730	9.1%	1,403	10.1%
Services and Professional	2,286	43.9%	11,313	59.3%	9,027	65.1%
Transportation & Public Utilities	184	3.5%	451	2.4%	267	1.9%
Wholesale Trade	107	2.1%	417	2.2%	310	2.2%
Retail Trade	1,037	19.9%	3,366	17.6%	2,329	16.8%
Finance, Insurance & Real Estate	291	5.6%	1,692	8.9%	1,401	10.1%
Services (Health, Legal, Business, etc.)	667	12.8%	5,387	28.2%	4,720	34.0%
Construction	238	4.6%	1,333	7.0%	1,095	7.9%
Government	1,356	26.1%	3,785	19.8%	2,429	17.5%

[1] Agricultural Services includes soil preparation services, crop services, etc. It also includes forestry services, such as reforestation services, and fishing, hunting, and trapping.
[2] Manufacturing includes forest products (i.e., paper, lumber and wood products).
Source: Sonoran Institute 2005.

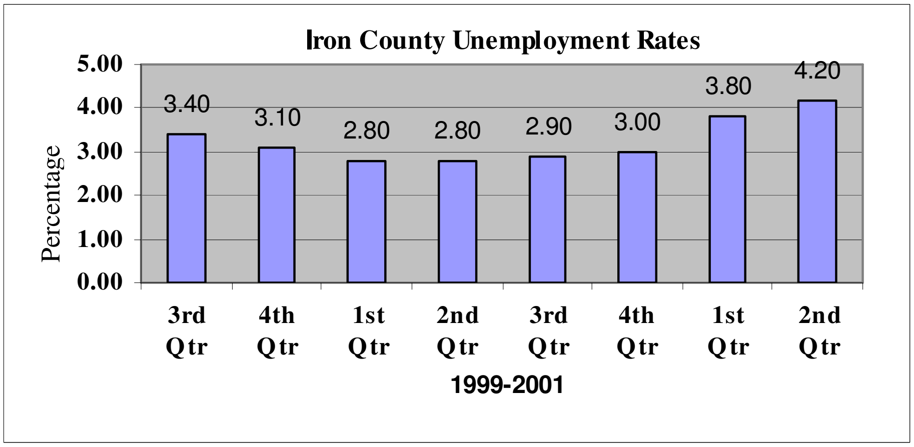

Figure 3.12. Iron County unemployment rates 1999–2001. Source: Utah Department of Workforce Services 2001.

After losing jobs for almost a year, Iron County began creating jobs again as early as February 2002. The most recent figures available show Iron County with annual job growth rate of 3% (Utah Department of Workforce Services 2002). Manufacturing, construction, financial services, wholesale trade, social assistance, and government all added new positions throughout 2002. However, several industries continue to struggle, including mining, trucking, and the restaurant industry (Utah Department of Workforce Services 2002).

3.11.1.3.2 INCOME

In 1999, the median household income in Cedar City was $32,403, well below the national average of $41,994. Forty-six percent of households earned less than $30,000. The majority of residents earned less than $30,000 (79%; Table 3.23). In 1999, wage and salary comprised 71.7% of income, while 8% came was derived from self-employment income (Sonoran Institute 2005).

Across the country, non-labor income has become an increasingly important component of the economy. Non-labor income includes income from dividends, interest, rent, and transfer payments. In 2002, 34.8% of Iron County's total personal income was generated from non-labor sources. The rate of growth for non-labor sources in the last 32 years is 5.7%, outpacing labor sources, which grew at a 3.9% rate (Sonoran Institute 2005).

The largest component of non-labor sources are from dividends, interest and rent transfer payments. In 2002, 54% of transfer payments (payments from governments to individuals) were from age-related sources including retirement, disability, insurance payments, and Medicare; 11% of payments (2% of total personal income) were from welfare.

Table 3.23. Cedar City Income Distribution

	Men	Women	Total	% of Total	% making less than	% making more than
$1 to $2,499 or less	518	999	1,517	12%	12%	100%
$2,500 to $4,999	532	1,065	1,597	13%	25%	88%
$5,000 to $7,499	459	877	1,336	11%	36%	75%
$7,500 to $9,999	382	566	948	8%	44%	64%
$10,000 to $12,499	621	633	1,254	10%	54%	56%
$12,500 to $14,999	297	195	492	4%	58%	46%
$15,000 to $17,499	401	353	754	6%	64%	42%
$17,500 to $19,999	219	249	468	4%	68%	36%
$20,000 to $22,499	333	184	517	4%	72%	32%
$22,500 to $24,999	150	122	272	2%	75%	28%
$25,000 to $29,999	364	206	570	5%	79%	25%
$30,000 to $34,999	349	170	519	4%	84%	21%
$35,000 to $39,999	385	87	472	4%	87%	16%
$40,000 to $44,999	232	142	374	3%	90%	13%
$45,000 to $49,999	210	88	298	2%	93%	10%
$50,000 to $54,999	109	5	114	1%	94%	7%
$55,000 to $64,999	242	31	273	2%	96%	6%
$65,000 to $74,999	182	18	200	2%	98%	4%
$75,000 to $99,999	113	37	150	1%	99%	2%
$100,000 or more	118	15	133	1%	100%	1%
Total:	6,216	6,042	12,258	100%		

Source: Sonoran Institute 2005.

3.11.1.3.3 HOUSING AFFORDABILITY

Approximately 52.2% of housing units are owner-occupied or for sale, while 44% are renter occupied or for rent. For comparison, the Utah average is 75.1% of homes owner-occupied. Although low, this number may reflect the high percentage of students that live in Cedar City attending SUU. Nearly 40% of all homes built in Cedar City were built between 1990 and 2000, reflecting the tremendous growth the City experienced during that period. A housing index rating greater than 100 means that a median family with 20% down can qualify for a median family home. Cedar City's housing index is 109, with the median value of a home being $121,600 (Sonoran Institute 2005).

The cost of flood insurance is directly related to the insured dwelling's proximity to a floodplain. According to the Leavitt Group in Cedar City, Utah, there are currently two types of flood insurance: Preferred Risk and the Natural Disaster Program. Assuming the average cost of a home is $150,000 and is not in a designated floodplain, the home would be eligible for Preferred Risk, which would cost approximately $264 per year. However, if the same house was located within the floodplain, the house would then have to be covered under the Natural Disaster Program. The cost of the program, approximately twice as much as the Preferred Risk, covers floods, earthquakes and landslides. The waiting period for the Preferred is 30 days, while the Natural Disaster Program is 15 days.

3.11.1.4 ENVIRONMENTAL JUSTICE

The Executive Order on federal actions to address environmental justice in minority populations and low-income populations (Executive Order 12898, with explanatory memorandum) directs federal agencies to assess whether their actions have disproportionately high and adverse human health or environmental effects on minority and low-income communities.

Varying levels of income are dispersed adjacent to the corridor. However, the row of block homes slightly north of the Paiute Indian Tribe of Utah headquarters, known as Paiute Village, and the residences dispersed throughout the primarily industrial and commercial area bordering the corridor east of I-15 are known to experience a higher rate of flooding; both are areas known to house lower-income individuals and families.

Potential eminent domain issues may arise if the creek corridor and parkway are modified and constructed. As of 1999, 22% of Cedar City's population, encompassing all races and ethnicities, was living below the poverty line (Table 3.24). The race with the highest poverty rate was the Native Hawaiian and Pacific Islander, with 76% (or 57 individuals) below the poverty line, followed by the Asian and American Indian communities.

Cedar City is the Tribal headquarters of the modern Southern Paiute Indian Reservation. Their ancestors used the plants and animals of the basin/plateau environment in a complex seasonal pattern. The Utah Tribe is broken into 5 distinct bands: Cedar City, Indian Peaks, Shivwits, Kanosh, and Koosharem (Utah Department of Community and Economic Development 2005). In 1954, the federal government terminated recognition of the Utah Tribe,

Table 3.24. Poverty by Ethnicity in Cedar City, 1999

	Total Below Poverty Line	Percent Below Poverty Line
White/Caucasian	3,888	21%
Black/African American	23	40%
American Indian and Alaska Native	163	45%
Asian	114	47%
Native Hawaiian and Other Pacific Islander	57	76%
Other Race	50	25%
2 or more races	118	24%
Hispanic or Latino	141	20%

Source: Sonoran Institute 2005.

making it ineligible for benefits and assistance for 26 years. The unfortunate result of this policy was the death of nearly one-half of all Tribal members due to lack of health resources, inadequate income to provide for daily needs, and a subsequent loss of a majority of Tribal lands due to their inability to pay property taxes (Utah Department of Community and Economic Development 2005).

It was not until 1980 that Congress passed the Paiute Reservation Plan to partially recover lost lands due to termination. The new lands are smaller parcels, selected due to their economic potential, primarily along I-15 and I-70. The Tribe also agreed to a $2.5-million, irrevocable trust fund to assist the Tribe in economic development and Tribal government (Utah Department of Community and Economic Development 2005).

The Paiute Tribe constitutes both a minority and low-income community. With a population of 250, the Paiute Reservation comprises approximately 1.2% of the City population. In 1999, 83% of households in the Paiute Reservation of Utah earned less than $30,000, while the income bracket with the largest number of households is less than $10,000. The unemployment rate for those aged 16 and over in 1999 was 34%, while 22% worked less than 35 hours per week.

3.11.2 Indicators

Indicators of the affected environment as they relate to socioeconomics and environmental justice include a change in flood insurance premiums, a change in open-space acreage due to the parkway expansion, changes in property values depending on proximity to the parkway, and dislocated or unfairly impacted poor or minority citizens due to the project implementation. Indicators also include employment rates, changes in employment sectors, and jobs created.

3.11.3 Environmental Consequences of Alternative A: No Action

The No Action Alternative includes continued dredging in the channel when and where necessary, but no additional on-site construction equipment, and no additional erosion control, streambank hardening, or parkway improvements.

3.11.3.1 Direct and Indirect Effects

The direct and indirect effects of the No Action Alternative on the social characteristics of Cedar City would be minimal. However, without flood control, large flooding events remain a realistic threat. Flood costs include not only damage to structures, agricultural land, and property in the floodplain, but also the cost of cleanup by city crews, missed work days, and increases in flood insurance premiums. Flooding may also create economic hardships for those not adequately insured. Most importantly, flooding poses a significant danger to citizens throughout the City. In the event of a 100-year flood, homes in the existing 100-year floodplain would sustain disproportionate flood damage compared to the rest of the community. This may affect homes and lower-income families in Paiute Village as well as scattered residences in the industrial and commercial areas adjacent to the Coal Creek corridor.

The National Economic Development (NED) analysis in Section 3.12 contains a benefit-cost ratio detailing the economic costs and benefits of this alternative (see Appendix D for further detail).

3.11.3.2 Mitigation

Mitigation measures should include scheduling dredging activities at periods of low flow to minimize the risk of flood events, ensuring the safety of lives and property along the stream corridor.

3.11.4 Environmental Consequences of Alternative B: Relocate Main Street Diversion

Alternative B proposes demolishing the Main Street Diversion and rebuilding it approximately 1,600 feet further east of its current location, near 200 East. Implementation of this alternative would require approximately 3,250 feet of pipeline to be installed, flood and slope/grading-related channel modifications from Center Street to I-15, and the continuation of periodic dredging as necessary. To assure continuity and access, the parkway system would allow for pedestrian access through use of a surface road crossing across Main Street. Currently, there are 2 parkway options to facilitate the crossing:

- Parkway Option B1 – Develop or enhance a crosswalk at the Main Street Bridge to connect the parkway trail. This option would require potential property or easement acquisition.

- Parkway Option B2 – Develop or enhance the trail using existing sidewalks and ROW. The trail would cross to the south side of the creek at a proposed 400 North pedestrian bridge. The route would then traverse north along the east side of Main Street to the Coal Creek crossing and use a street crosswalk to access the trail on the west side of Main Street. This parkway option would not require property or easement acquisition near Main Street.

3.11.4.1 Direct and Indirect Effects

The implementation of Alternative B would beneficially impact the social characteristics of Cedar City. The improved parkway trail would connect the east side of the City with Airport Road to the west of I-15 and would link various residential neighborhoods, commercial and industrial areas, and Native American, federal, state and municipal lands. Linking the various neighborhoods with open space and other land uses, the trail would be used by people of all ethnicities and economic statuses. By doing so, Alternative B would offer opportunities for strengthened awareness and appreciation of diversity, a stronger sense of community, and an increased quality of life.

As the floodplain is reduced, the value of property (primarily residential and commercial buildings, but also some agricultural property) within the 100- and 500-year floodplains would increase (see Appendix D). In total, if Alternative B is implemented, 112 parcels would be removed from the 100-year floodplain but would remain in the 500-year floodplain, while another 457 parcels would be removed from the 500-year floodplain altogether. Of the 112 parcels that would remain in the 500-year floodplain, 65 parcels are privately owned, and 47 are publicly owned. Of the privately owned parcels, 30 are classified residential, 19 are private undeveloped land, and 16 are non-residential (developed).

The 457 parcels currently in the 500-year floodplain would no longer be in a floodplain if Alternative B is implemented. Of these 457 impacted parcels, 386 are privately owned, with 229 residential, 45 private land, and 112 non-residential private developments. The remaining 71 parcels are publicly owned.

Access to leisure and recreational opportunities has become a priority for homebuyers and employers. With potential of attracting homebuyers and new business to the City, the extension of the parkway would have a beneficial impact on economic development in Cedar City. The extension also has the potential to create jobs, enhance property values, expand local businesses, attract new or relocating businesses, increase local tax revenues, decrease local government expenditures, and promote local community pride (NPS 1995). A number of temporary construction jobs would be created for the 1–2 years of channel modification and parkway construction. Additional employment opportunities would exist for ongoing maintenance of the corridor.

Structural value associated with publicly owned parcels moved from the 100-year to the 500-year floodplain totals $4,456,193; parcels moved out of the 500-year floodplain total $10,479,246. Structural values for public parcels in Iron County are not recorded by the

County Assessor. Thus, structural values for public parcels within the floodplains were estimated using the average structural value per commercial acre for property within the floodplain (see Appendix D for further description and methodology).

Since flood damage cost savings will only occur in the event of flooding, the reduced damages calculated (see Appendix D) must be adjusted according to the probability of a 100-year or 500-year flood. In any given year, the probability of a 500-year flood occurring is 0.2%, and the probability of a 100-year flood occurring in any given year is 1.0%. These probabilities are multiplied by the total estimated damages for the 100- and 500-year floods to calculate an "average" annual savings, thus spreading flood reduction savings evenly over the appropriate number of years. Total flood reduction damages for private properties are estimated at $932,668 and $379,296 for public properties, for a grand total of $1,311,964 in flood reduction damages (see Appendix D for further description and methodology).

The NED analysis in Section 3.12 contains detailed descriptions of the benefit-cost ratios for this alternative (see Appendix D for further detail).

This alternative would not result in the relocation or the loss of jobs for any low-income or minority communities. In fact, it would decrease flood insurance premiums and potential flood damage costs for all residents in Cedar City. Consequently, this alternative would have no adverse impacts on low-income or minority communities.

3.11.4.2 MITIGATION

Ongoing maintenance and channel modifications under this alternative would limit flooding potential ensuring the safety of its users. It would also ensure lasting economic benefits for the City. Accordingly, no mitigation measures are necessary for this alternative.

3.11.5 ENVIRONMENTAL CONSEQUENCES OF ALTERNATIVE C: REPLACE MAIN STREET DIVERSION

Alternative C proposes replacing the current Main Street Diversion with a new diversion in the same location. The North Field Canal option proposes to use one pipe instead of three pipes to convey irrigation water from the sediment basin to the existing irrigation system.

Under this alternative, access across Main Street would be facilitated through the construction of an underpass on the north side of the creek at the Main Street Bridge. Two parkway options are currently being studied:

- Parkway Option C1– Construct a concrete path under the Main Street Bridge that would be elevated several feet above the channel invert. This parkway option would require potential property or easement acquisition on the north side of the channel.

- Parkway Option C2 – Construct a large box culvert parallel to the creek and adjacent to the Main Street Bridge that would be dedicated for pedestrian use. This parkway option would likely require property or easement acquisition.

3.11.5.1 Direct and Indirect Effects

Implementation of Alternative C would result in the same social and economic effects and environmental justice impacts as those described under Alternative B.

The NED analysis in Section 3.12 contains benefit-cost ratios for this alternative (see Appendix D for further detail).

3.11.5.2 Mitigation

The mitigation measures for Alternative C would be the same as those under Alternative B.

3.12 National Economic Development (NED) Analysis

3.12.1 Overview

National economic development (NED) accounting is conducted in order to analyze whether alternatives for a proposed, federally funded water resource project, if implemented, would be beneficial to the national economy as a whole, from the standpoint of market-valued benefits and costs. Once NED accounting is completed for a given project, the alternative found to maximize net economic benefits at the national level is designated as the NED Alternative.

There are different approaches to NED accounting and associated benefit-cost analysis. The process used in the Coal Creek EIS follows a standard benefit-cost analysis approach, using present net value for all public and private benefits and costs. The same analysis is used for each Coal Creek alternative under consideration.

Analysis shows that the objectives of the Coal Creek project (i.e., to reduce flood damages and to enhance the recreational experience along the parkway) would be met by reducing the size of the 100-year and 500-year floodplains (and thus reducing the potential for flood damages) and by increasing the number of recreation users along the parkway as well as the overall recreation experience at the parkway (based on survey responses), respectively. The following material is a summary of the analysis presented in the Coal Creek NED analysis found in Appendix D.

3.12.2 PROJECT BENEFITS

3.12.2.1 FLOOD DAMAGE REDUCTION

Improving the Coal Creek Parkway via Alternative B or Alternative C would reduce the likelihood of flood damage to nearby property by reducing the size of the 100-year and 500-year floodplains. Existing 100- and 500-year current floodplains and proposed reduced floodplains from channel improvements are shown in Figure 2.1.

Flood damage within these floodplains would primarily impact property improvements such as buildings, both residential and commercial, although some agricultural property is included in the 500-year floodplain. In total, if improvements are made to the project corridor, 112 parcels would be removed from the 100-year floodplain but would remain in the 500-year floodplain, while another 457 parcels would be removed from the 500-year floodplain altogether (see Section 3.11, Socioeconomics and Environmental Justice). For a full description of the assumptions and methodology used for this NED analysis, see Appendix D.

Since flood damage cost savings will only occur in the event of flooding, the structural and personal property damages calculated must be adjusted according to the probability of a 100-year or 500-year flood. The damages to be adjusted are shown in Tables 3.25 and 3.26 as follows for both private and public structures and personal property.

In any given year, the probability of a 500-year flood occurring is 0.2%. Similarly, the probability of a 100-year flood occurring in any given year is 1.0%. These probabilities are multiplied by the total estimated damages for the 100- and 500-year floods, respectively, to calculate an "average" annual savings, thus spreading flood reduction savings evenly over the appropriate number of years. A present value of this potential future stream of cost savings was then calculated using the published FY 2005 discount rate for water resource projects (5.375%). This results in an estimated $932,668 in private savings and $379,296 in public savings in flood reduction damages (see Table 3.27).

Table 3.25. Total Flood Damage Reduction Value, Private Property

Property Type	100-yr Flood Savings	500-yr Flood Savings
Real Property (Structures)	$539,319	$1,389,324
Personal Property	$856,964	$6,731,876
Total Value	$1,396,283	$18,121,199

Table 3.26. Total Flood Damage Reduction Value, Public Property

Property Type	100-yr Flood Savings	500-yr Flood Savings
Real Property (Structures)	$445,619	$2,724,604
Public Property	$824,396	$1,152,717
Total Value	$1,270,015	$3,877,321

Table 3.27. Total Flood Damage Reduction Value, Private and Public Property

Discounting	100-yr Flood Savings	500-yr Flood Savings	Total Savings
Probability	1.0%	0.2%	—
Yearly Probable Value – Private	$13,963	$36,242	
Yearly Probable Value – Public	$12,700	$7,756	
Discount Rate	5.375%	5.375%	—
Discounted (PV) – Private	$258,391	$674,277	$932,668
Discounted (PV) – Public	$235,024	$144,272	$379,296
Total – Public and Private Discounted	$493,415	$818,550	$1,311,964

Tables 3.25–3.27 summarize the discounted cost savings due to reduced flood damage associated with Alternatives B and C. The proposed channel improvements and floodplain reduction is the same for each alternative, providing substantial benefits to public and private property owners.

There is seasonal, localized flooding outside of mapped FEMA floodplains that is associated with high-discharge events in Coal Creek. Localized flooding in the vicinity of the North Field Canal and 1045 North is tied to discharge in Coal Creek. Cedar City estimates that flooding occurs in this area three times annually. Cedar City also estimates that public cleanup and restoration due to the flooding of existing open ditch canals costs approximately $10,000 annually. The City estimates the annual costs to private property owners to restore damaged fences, landscaping, and basements is approximately $2,500. Elimination of these costs under the North Field Canal option would provide a benefit of approximately $12,500 annually (see Table 3.28).

Implementation of the North Field Canal option would also reduce flooding and associated cleanup costs outside of the FEMA floodplains. The North Field Canal option would result in an estimated $1,025,443 in private savings and $750,864 in public savings in flood reduction damages both within and without the mapped FEMA floodplains (Table 3.28).

Table 3.28. Total Property Flood Damage Reduction Value – Private and Public for North Field Canal Option

Discounting	100-yr Flood Saving	500-yr Flood Saving	Total Savings
Probability	1.00%	0.20%	
Yearly Probable Value – Private	$16,463	$38,742	
Yearly Probable Value – Public	$22,700	$17,780	
Discount Rate	5.375%	5.375%	
Discounted (PV) – Private	$304,655	$720,789	$1,025,443
Discounted (PV) – Public	$420,080	$330,784	$750,864
Total – Public and Private Discounted	$724,734	$1,051,573	$1,776,307

3.12.2.2 Real Estate Value

Using various studies (Hammer et al. 1974; Correll et al. 1978; Anderson 2000; Espey and Owusu-Edusei 2001), this analysis estimates that property values would increase up to a distance of 3,200 feet from the proposed parkway.

While all property (publicly and privately owned) benefits from close proximity to parkways, this analysis quantifies only impacts to private property. Although public property values would increase, such land is infrequently sold on the market and, hence, the price appreciation is rarely realized.

The average increase in value for all properties is 6.7%, which equates to an increase of more than $19 million in added value for privately owned properties (Table 3.29).

Table 3.29. Private Property Value Appreciation Ranges

Distance (feet)	0-50	51-999	1,000-1,500	2,500-3,200	Total
Average Appreciation	28.0%	15.0%	11.0%	4.2%	
Value/Range	$3,090,467	$6,240,535	$84,176,361	$191,140,522	$284,647,885
Increased Value	$875,632	$936,080	$9,259,400	$8,027,902	$19,099,014
Total Value	$3,966,099	$7,176,615	$93,435,761	$199,168,424	$303,746,899

However, this value will not all be realized immediately. No benefit would accrue to private owners until properties are sold and the added gains are realized. Therefore, for this analysis, the $19,099,014 has been discounted as if the entire value is not reached until five years in the future (assuming some sales will occur before and some after that time period; U.S. Census Bureau 2000b).[2] This discounting results in a present value of $14,700,192 increased private real estate value due to parkway improvements.

3.12.2.3 Recreation Use

Recreation facilities provide benefits to the local and tourist population that are more qualitative than quantitative in nature and, thus, more difficult to measure. Recognizing the difficulty of assessing these types of benefits, the NRCS outlines a "Unit Day Value Method" in its Water Resources Handbook for Economics (NRCS 1998a; see Appendix D for details).

Using this method, it is estimated that the number of visitors per day would double with parkway improvements. This increase coupled with the average per day user value (Table 3.30; see Appendix D), would result in benefits of $866,145 annually. Over a 50-year timeframe, this results in a present value of nearly $15 million.

Table 3.30. Summary of Visitation and Recreation User Benefits

Current parkway visitation per day	350 visitors
Total visitation after parkway improvements	700 visitors
Additional visitors per year	127,750
Per-year value of increased visitation	$866,145
Discount rate	5.375%
NPV of increased visitation (50 years)	$14,938,527

Source: Personal communication with Bob Tate, Cedar City Parks and Recreation, April 2005.

3.12.3 Private Costs

No direct private costs were identified.

3.12.4 Public Costs

The estimated construction costs for each of the alternatives and options are provided in Table 3.31. All construction costs are considered to be upfront costs incurred in the initial year of construction (personal communication with Craig Bagley, Bowen, Collins & Associates, October 2005).

2. Census 2000 data for Cedar City states that the median year a householder moved into an owner-occupied unit was 1995—a period five years previous to the 2000 Census.

Table 3.31. Construction Costs, by Alternative

Alternatives	Channel Improvement Costs General and Structural Construction Costs	Parkway Construction Costs	Easement Acquisition	Annual O&M Costs	Total Cost
A. No Action.	—	—		28,000	$28,000
B1. Relocate Main Street Diversion upstream (with surface crossing at Main Street Bridge).	14,626,300	1,454,600	Yes	9,000	$16,089,900
B2. Relocate Main Street Diversion upstream (with surface crossing using 400 North pedestrian bridge).	14,626,300	1,469,750	No	9,000	$16,105,050
C1. Replace Main Street Diversion (pedestrian crossing using elevated concrete path under Main Street Bridge).	14,717,700	1,460,900	Yes	9,000	$16,187,600
C1 w/ North Field Canal Option.	15,294,200	1,460,900	Yes	7,500	$16,762,600
C2. Replace Main Street Diversion (pedestrian crossing using box culvert adjacent to and north of Main Street Bridge).	15,197,000	1,460,900	Yes	9,000	$16,666,900
C2 w/ North Field Canal Option.	15,773,400	1,460,900	Yes	7,500	$17,241,800

3.12.5 Benefit-Cost Analysis

Table 3.32 summarizes the benefit-cost ratio for each of the alternatives. Note that benefits vary only slightly between the alternatives with and without the single-pipe option (North Field Canal). Thus, the resulting ratios for each of the alternatives are very similar in nature, ranging between 1.8:1 and 1.9:1. The analysis does not assume any increased real estate values for public buildings located in the proximity of the parkway. If, however, public properties were to be put on the market, or if they were to be used as security (as an asset) in funding scenarios, the added value would be of benefit to the public.

With the exception of Alternative C, including Parkway Option C2 and North Field Canal option, all of the Alternatives/Options have a ratio of 1.9:1 and are accordingly designated as the NED Alternatives (Table 3.32; Section 2.6). This indicates that the costs and benefits of all of the alternatives are relatively consistent.

3.13 Cumulative Impacts

3.13.1 Air Quality

Cumulative, short-term effects on air quality are anticipated to include emissions from private vehicle traffic during construction work in or near the I-15 corridor, and from construction vehicles operated on land immediately adjacent to the project area during the construction period (e.g., construction of a subdivision occurring at the same time as and immediately adjacent to the parkway expansion work). The primary sources of air quality effects from adjacent construction work or traffic are exhaust emissions and dust production. The magnitude of air quality effects associated with these activities is directly related to the density and intensity with which both the project-related and adjacent activities proceed. They are projected to be short-term and (given the existing high level of air quality and the conservative nature of project-related air quality effects) are not expected to result in violation of applicable air quality standards.

Long-term, cumulative effects are projected to be specific to population growth in and around the project area, with attendant increases in pollutants from vehicle emissions.

Expansion of the Ashdown Wilderness Area (if it occurs) would protect additional acres in the upstream watershed from erosion-inducing activities, exerting a protective effect on air quality by potentially reducing (incrementally) current background PM_{10} and $PM_{2.5}$ loading.

Table 3.32. Benefit-cost Analysis

	BENEFITS					COSTS		NET IMPACTS	BENEFIT: COST RATIO
	Flood Reduction		Recreation Use	Real Estate					
Land Ownership	Private	Public	Public	Private	Public	Private	Public	Public and Private	Public and Private
A			$0	$0	$0	$0	$28,000	-$28,000	NA
B1	$932,668	$379,296	$14,938,527	$14,700,192	$0	$0	$16,089,900	$14,860,783	1.9:1
B2	$932,668	$379,296	$14,938,527	$14,700,192	$0	$0	$16,105,050	$14,845,633	1.9:1
C1	$932,668	$379,296	$14,938,527	$14,700,192	$0	$0	$16,187,600	$14,763,083	1.9:1
C1 w/ canal	$1,025,443	$750,864	$14,938,527	$14,700,192	$0	$0	$16,762,600	$14,652,426	1.9:1
C2	$932,668	$379,296	$14,938,527	$14,700,192	$0	$0	$16,666,900	$14,283,783	1.9:1
C2 w/ canal	$1,025,443	$750,864	$14,938,527	$14,700,192	$0	$0	$17,241,800	$14,173,226	1.8:1

Shading indicates the NED Alternatives.

3.13.2 Geology and Soils

Future cumulative actions in the project area that could impact soils and geology include the Southwest Wildlife Foundation's plans for a wildlife rescue park and exhibit area near the UP&L drop structure. This development would likely have direct, beneficial effects on native vegetation in sub-reach A (from UP&L drop structure to Center Street Bridge) because of active efforts to restore vegetation and preserve habitat in and around the rescue park. Restoration of this vegetation would also benefit soils resources by stabilizing soil, thereby preventing erosion. Additionally, revegetation would provide additional organic material that would increase soil productivity.

Because sub-reach F (from I-15 to Airport Road) is not vegetated, future residential development of 400 acres west of I-15 at Lund Highway could positively impact soil resources if this development includes revegetation.

Dixie National Forest is recommending expanding the Ashdown Wilderness Area, which would protect additional acres in the watershed above the UP&L drop structure from erosion-inducing activities. This in turn would provide additional protection of soil resources in the vicinity of the project area.

Recent past impacts on soils in the project area include the emergency streambank stabilization and channel modifications throughout the project area that resulted in the removal of sediment in the Coal Creek channel. Until these areas are revegetated, they pose a risk of soil loss through erosion.

The continued rapid population growth in Cedar City will likely result in additional soil disturbance throughout the vicinity of the project area as residential development continues outward from Cedar City into undisturbed open areas and onto the benches on the surrounding hillsides. This disturbance could result in short-term soil loss due to erosion until disturbed areas are revegetated. Of particular concern is potential construction on the hills above Cedar City where soil types have high erosion potential because their location on steep slopes.

3.13.3 Surface and Groundwater Resources

Cumulative, short-term effects on water quality are anticipated to include the potential for increased suspended sediment loading, as well as sediment deposition and turbidity during construction work in or near the I-15 corridor and from construction on land immediately adjacent to the project area during the project construction period (e.g., construction of a subdivision occurring at the same time as and immediately adjacent to the parkway expansion work). The primary sources of water quality effects from adjacent construction work would be storm event-driven erosion of disturbed surfaces and material storage areas. The magnitude of water quality effects associated with these activities would be directly related to the density and intensity with which both the project-related and adjacent construction proceeds.

Long-term cumulative effects are projected to be specific to population growth in and around the project area, with attendant increases in stormwater runoff due to increased impervious surfaces. If appropriate siting and management practices are applied, the additional runoff is not expected to result in water quality violations.

Projected development west of I-15 (1600 North at Lund Highway) on acreage being annexed by Cedar City is expected to have minimal to negligible effects on water quality during construction, provided that appropriate siting and management practices are applied. Additional stormwater runoff may be generated by the increase of impervious surfaces within this development, but this additional runoff should not affect instream water quality if appropriate stormwater management practices are applied and maintained.

If expansion of the Ashdown Wilderness Area occurs, it would protect additional acres in the upstream watershed from erosion-inducing activities, exerting a protective, beneficial cumulative effect on water quality instream and potentially reducing (incrementally) current sediment and turbidity loading.

Since the majority of aquifer recharge occurs downstream of the project corridor, cumulative effects on groundwater quality are projected to be negligible. Future population growth in the Cedar Valley should consider groundwater supply limitations specific to aquifer recharge. However, since the Proposed Action is not anticipated to have an appreciable effect on water supply, cumulative effects specific to the Proposed Action are projected to be negligible.

3.13.4 Vegetation Resources

Future cumulative actions in the project area that could impact vegetation include the Southwest Wildlife Foundation's plans to construct a wildlife rescue park and exhibit area near the UP&L drop structure. This development would likely have direct, beneficial effects on native mountain shrub vegetation and associated riparian vegetation in sub-reach A because of active efforts to restore native vegetation and preserve habitat in and around the rescue park. Because sub-reach F is not vegetated, future residential development of 400 acres west of I-15 at Lund Highway could positively impact native vegetation there if the developers replant the area with native species. However, if the area is not reseeded, the banks are likely to be invaded by noxious weeds and other undesirable plant species.

Dixie National Forest is recommending expanding the Ashdown Wilderness Area, which would protect additional acres in the watershed above sub-reach A from erosion-inducing activities that could negatively impact native vegetation in the project area.

Recent impacts on the native vegetation in the project area include the emergency streambank stabilization and channel modifications throughout the project area that resulted in the removal of some of the vegetation in and around the streambank. If these areas are not reseeded, there will be adverse impacts on the surrounding native sagebrush/perennial grass, mountain shrub, and riparian habitats due to invasion by weedy species that will eventually spread to surrounding vegetated areas in and outside of the project area.

The continued rapid population growth in Cedar City will likely result in additional disturbance in both the sagebrush and mountain shrub vegetation communities as residential development continues outward from Cedar City into open sagebrush steppe and onto the benches on the surrounding hillsides.

3.13.5 Wetlands and Riparian Resources

Over the last 150 years, Coal Creek has been substantially impacted by the construction of irrigation diversion and drop structures and the diversion of irrigation waters to the surrounding areas. Historical photographs indicate that Coal Creek had denser and more substantive riparian habitat throughout the project area in the late 1800s and early 1900s. Additionally, those reaches of Coal Creek currently running through town had some meander pattern with functioning floodplains that appeared to be seasonally inundated. This likely allowed for the regeneration of cottonwood galleries and willows. However, historical modifications to the Coal Creek channel and floodplain have decreased the ecological conditions necessary for the formation and perpetuation of wetlands and riparian resources. Construction of instream diversions have increased incisement and isolated the floodplain from the channel, decreasing seasonal inundation and, consequently, the recruitment of riparian vegetation. Additionally, developmental pressures have constrained the channel to its present location, particularly in the middle and lower reaches. Continued dredging decreases the potential for wetland and riparian formation. The irrigation demands remove water from the channel for much of the year, such that there is no water to support wetlands or riparian resources in the downstream reaches of the creek. As a result of all these past cumulative impacts, the existing riparian habitat is of quite poor quality in comparison to the historic riparian habitat that existed prior to the 1900s.

Considering that most of the modifications associated with the Proposed Action would occur where there is no existing wetland or riparian habitat, cumulative, adverse impacts to wetlands and riparian resources as a result of the proposed project are unlikely to occur.

Planned future developments within the project area include the Southwest Wildlife Foundation's plans for a rescue park and exhibit area near the UP&L drop structure. As long as construction does not remove potential riparian resources, this development would likely have direct, beneficial effects to riparian resources due to active efforts to restore native vegetation and preserve habitat in and around the rescue park.

Future residential development of 400 acres west of I-15 at Lund Highway would not impact wetlands and riparian resources.

Dixie National Forest is recommending expanding the Sadden Wilderness Area, which would protect additional acres in the watershed above the project area from erosion-inducing activities that could negatively impact wetlands and riparian resources in the project area.

3.13.6 Wildlife Resources (Including TES)

Future cumulative actions in the project area that could impact wildlife habitat include the Southwest Wildlife Foundation's plans for a wildlife rescue park and exhibit area near the UP&L drop structure. This development would likely have direct, beneficial effects on both mule deer, black bear, and mountain lions by preserving existing habitat in and around the rescue park. This would also benefit riparian dependent species in sub-reach A because of the proposed preservation or restoration of native vegetation in this area, which would decrease erosion and sedimentation impacts to the riparian zone.

Dixie National Forest is recommending expanding the Ashdown Wilderness Area, which would indirectly protect wildlife habitat by managing the expanded area for primitive recreational opportunities. This would include eliminating motorized use in the area, thereby reducing habitat impacts and noise disturbance to wildlife.

The continued rapid population growth in Cedar City will likely result in additional disturbance in both the sagebrush and mountain shrub vegetation communities as residential development continues outward from Cedar City into open sagebrush steppe and onto surrounding hillsides. These habitat types support upland bird species, black bear, mule deer, and mountain lion, as well as many non-game species. Development on the benches would specifically impact wintering habitat for mule deer, with subsequent impacts to mountain lion.

3.13.7 Cultural Resources

Cumulative impacts to historic properties would likely be few, regardless of the alternative that is selected. Although the Coal Creek Parkway project would initially modify Coal Creek's channel characteristics through lower Cedar Canyon and Cedar City, flow downstream from and west of Airport Road would eventually return to current conditions. No changes in streamflow outside the APE are foreseen and, over time, no cumulative changes to the existing conditions would likely result.

It is reasonably foreseeable that, if an action alternative is selected, direct impacts to historic irrigation features and the networks they serve would result when conflicts between community development and agricultural tradition are resolved by successively burying segments of open ditches. Alternative B and Alternative C would result in the demolition and replacement of one historic water diversion structure. Accompanying this reconfiguration would be the subsurface piping of the head segments of three historic irrigation features. Both action alternatives contribute to the process of burying segments of irrigation networks that compete with trends of modern development. It is reasonably foreseeable that, in time, open primary irrigation canals within Cedar City may be completely eliminated. The action alternatives proposed as part of Coal Creek Parkway project would result in the burial of the head segments of three historic irrigation canals.

Segments of the three historic canals extend beyond the APE and have not yet been documented as elements of cultural resource sites. The effects of subsurface piping may already have impacted some segments, while others likely retain the historic integrity of open irrigation canals. It is reasonably foreseeable that by piping the head segments of these canals, downstream piping of segments that are presently open may be more prone to subsurface piping.

The loss of the segments of historic irrigation features that occupy the APE would be mitigated if an action alternative is selected. The terms of this mitigation could be established in such a way that the entirety of the primary canals directly impacted as a result of completion of the Coal Creek Parkway project would be taken into account.

In the event that trail development under Alternative C requires physical impacts to the Main Street Bridge (Site 42IN2285), it should be noted that future plans of UDOT include possible structural improvements to the bridge surface. Typically, resurfacing a bridge structure with materials that are identical to the original surface treatment does not constitute an adverse impact. If UDOT completes resurfacing without making any changes to the bridge's integrity, it is not probable that cumulative effects to this historic property would occur.

No additional cumulative effects to historic properties have been identified.

3.13.8 Recreation and Visual Resources

The Proposed Action, in combination with current citywide and countywide recreation facilities, would provide for an extensive network of various recreational opportunities, while connecting four of Cedar City's largest parks. This combination with cooperative regional efforts may have a considerable beneficial effect on recreational pursuits throughout the City and Iron County.

As mentioned above, the City hosts the annual Utah Summer Games as well as several festivals throughout the year. With the continuation of the parkway to Airport Road, the facility may provide opportunity for an increased number of events during the games, while the convenience of the trail would offer opportunity for festival events or visitors throughout the year.

As new, future development occurs around the parkway corridor, the number of people within the 0.75-mile radius would increase. This increase would bring more users to the trail increasing the direct and indirect effects discussed above.

3.13.9 Socioeconomics and Environmental Justice

The reasonably foreseeable, continued rapid growth in Cedar City would continue to provide both social and economic opportunities for residents. Likely consequences of this growth include increases in mean annual income, more and diverse job opportunities, increased retail sales, and an increased tax base. Adverse impacts of this growth may include the overburdening of aging or limited municipal infrastructure, increases in crime, and the loss of affordable housing for low-income residents.

Currently, residents from Nevada and California are buying property in the City for retirement homes or investment (Cedar City 2005a). If these trends continue, housing and property costs will continue to rise. The implementation of either of the action alternatives would contribute to this trend by increasing the aesthetic beauty of the City while decreasing the risk of owning and building on property adjacent to Coal Creek.

The rapid growth of population in Cedar City combined with the increased attractiveness of the community after implementation of either of the action alternatives would have substantial impacts on the socioeconomics of the area. The impacts would be largely beneficial but would also include the risk of adversely affecting low-income or minority populations that may not have the educational or financial opportunities to take advantage of this economic growth. The impacts to these populations may be exacerbated by the predicted increases in housing costs and cost-of-living.

Just upstream of I-15, Coal Creek splits into different channels. The channels west of I-15 would not be improved as part of this project. In 2005, both the Quichapa Channel and the main Coal Creek channel to the north sustained erosion and deposition damage from an estimated 1,900 cfs flowing through Coal Creek. This flow caused damage to a culvert under and diversion located at Airport Road, where the Coal Creek channel splits into a north and a west channel. The Quichapa Channel also experienced problems with bank and channel stability as a result of this flow. During a 100-year flood event, it is possible that high flows could overtop either the Quichapa Channel or the northern channel flowing under Airport Road. With the continued growth in Cedar City, particularly west of I-15, there is an increased risk than this channel failure would result in damage to residential areas. Iron County is seeking funding to develop a flood control plan for the area west of I-15. The county planning project is not connected to the proposed action and has independent utility.

West of I-15, residential and commercial development occurs within the 100-year floodplain (Figure 2.1). If a 100-year flood event occurs, this area would be subject to sheet flow of up to 12 inches of water. This would likely cause flood damage to many of these residential and commercial buildings, regardless of which project alternative is implemented.

3.14 Unavoidable Adverse Effects

3.14.1 Air Quality

There are no unavoidable adverse impacts to air quality projected under any of the alternatives.

3.14.2 Geology and Soils

Unavoidable bank erosion, increased stream incision with attendant increases in wind erosion, and sediment buildup would continue under Alternative A. Alternatives B and C would result in unavoidable disturbance impacts to approximately 25 acres of soil each.

3.14.3 Surface and Groundwater Resources

There are no unavoidable adverse impacts to water quality projected under any of the alternatives.

3.14.4 Vegetation Resources

Implementation of Alternative A would continue to foster unavoidable risks to riparian vegetation during high flow events due to potential for channel breaching and bank erosion. These risks include potential loss of streamside cottonwoods and willows, as well as the loss of herbaceous riparian vegetation. Implementation of Alternatives B and C would result in the unavoidable loss of approximately 20 acres of the disturbed sagebrush steppe/ perennial grass vegetation community and approximately 5 acres of mountain shrub vegetation community.

3.14.5 Wetlands and Riparian Resources

Implementation of Alternative A would continue to foster unavoidable risks to riparian vegetation and any off-channel wetlands during high flow events due to potential for channel breaching and bank erosion. These risks include potential loss of streamside cottonwoods and willows, as well as the loss of herbaceous riparian vegetation.

Implementation of Alternatives B and C would result in the potential unavoidable loss of the remaining riparian vegetation found along approximately 11,493 linear feet of Coal Creek.

3.14.6 Wildlife Resources (Including TES)

Implementation of the action alternatives would cause the unavoidable loss of trees as well as deer wintering habitat (9.76–11.31 acres), black bear year-long habitat (9.76–11.31 acres), mountain lion habitat (9.76–11.31 acres), and band-tailed pigeon habitat (6.01 acres), which cannot be mitigated in the short-term.

3.14.7 Cultural Resources

Although historic sites would be impacted by the proposed project, these impacts would be mitigated. Accordingly, there are no unavoidable adverse impacts to cultural resources as a result of this project.

3.14.8 Recreation and Visual Resources

There are no unavoidable adverse impacts to recreation or visual resources projected under any of the alternatives.

3.14.9 Socioeconomics and Environmental Justice

There are no unavoidable adverse impacts to socioeconomics or environmental justice projected under any of the alternatives.

3.15 Irretrievable and Irreversible Commitments of Resources

3.15.1 Air Quality

There are no irretrievable and irreversible commitments of air quality resources projected under any of the alternatives.

3.15.2 Geology and Soils

The approximately 25 acres of soil disturbance described for Alternatives B and C would be an irretrievable loss of that soil's productivity until that disturbance is stabilized and vegetated. However, there would be no irreversible loss of soil productivity as these areas would be restored.

3.15.3 Surface and Groundwater Resources

There are no irretrievable or irreversible commitments of water quality resources projected under any of the alternatives.

3.15.4 Vegetation Resources

The loss of approximately 20 acres of the disturbed sagebrush steppe/perennial grass vegetation community and approximately 5 acres of mountain shrub vegetation community under Alternatives B and C would be an irretrievable loss of that vegetation habitat, probably for a period of at least 20 to 30 years. It is possible that this habitat could be restored to native vegetation, however, therefore this loss would not be irreversible.

Under Alternative B, the potential loss of streamflow in 1,600 feet of the Coal Creek channel during the irrigation season could result in an irretrievable loss of riparian vegetation condition in that reach. However, this loss could be restored or mitigated through implementation of a maintenance flow in this reach of the channel during all or part of the irrigation season.

3.15.5 Wetlands and Riparian Resources

Under Alternative B, the potential loss of streamflow in 1,600 feet of the Coal Creek channel during the irrigation season could result in an irretrievable loss of riparian vegetation condition in that reach. However, this loss could be restored or mitigated through implementation of a maintenance flow in this reach of the channel during all or part of the irrigation season.

Implementation of Alternatives B and C would result in the irretrievable loss of the habitat and stabilization value of the remaining riparian vegetation on approximately 11,493 linear feet of stream channel until that vegetation is restored. However, as previously noted, this vegetation is scattered and of generally poor quality. Because this vegetation could be restored, there would be no irreversible loss of wetlands and riparian resources.

3.15.6 Wildlife Resources (Including TES)

The Coal Creek project would create an irretrievable loss of habitat associated with the clearing of any trees until they grow back, as well as irretrievable losses of critical wintering deer habitat (9.76–11.31 acres), black bear year-long habitat (9.76–11.31 acres), mountain lion foraging habitat (9.76–11.31 acres), and band-tailed pigeon habitat (6.01 acres) until the vegetation is able to grow back. No loss of habitat would be irreversible.

3.15.7 Cultural Resources

There are no irretrievable or irreversible commitments of cultural resources under any of the alternatives.

3.15.8 Recreation and Visual Resources

There are no irretrievable or irreversible commitments of recreation or visual resources projected under any of the alternatives.

3.15.9 Socioeconomics and Environmental Justice

There are no irretrievable or irreversible commitments of socioeconomic or environmental justice resources projected under any of the alternatives.

3.16 Relationship of Short-term Uses and Long-term Productivity

3.16.1 Air Quality

Short-term uses of project area resources would not adversely impact the long-term productivity for cultural resources under any of the alternatives.

3.16.2 Geology and Soils

The short-term disturbance, or use, of 25 acres of soil to modify and stabilize the Coal Creek channel will result in long-term improvements in soil productivity by decreasing stream channel and bank erosion and creating a channel that can handle extreme flood events without breaching or experiencing mass wasting.

3.16.3 Surface and Groundwater Resources

Alternative A would likely result in some loss of long-term productivity in terms of water quality in Coal Creek. The risk of erosion and potential channel failure all would result in increased sedimentation and decreased water quality.

Short-term uses of project area resources would not adversely impact the long-term productivity for surface or groundwater resources under any of the action alternatives.

3.16.4 Vegetation Resources

The disturbance of approximately 20 acres of the disturbed sagebrush steppe/perennial grass vegetation community and approximately 5 acres of mountain shrub vegetation would result in a long-term improvement in vegetation productivity in terms of improving riparian vegetation along the Coal Creek corridor and decreasing the potential for riparian vegetation loss from channel breaching or bank erosion.

3.16.5 Wetlands and Riparian Resources

The disturbance of the remaining riparian vegetation on approximately 11,493 linear feet of Coal Creek would result in a relatively short-term loss but would ultimately result in long-term improvement in riparian health and stability along Coal Creek in comparison with what currently exists. However, it should be noted that this productivity would be in an altered form in the middle reach of Coal Creek where the parkway would be constructed. In this area, streamside vegetation would likely be non-native, which would provide different habitat value than native vegetation.

3.16.6 Wildlife Resources (Including TES)

The short-term disturbances to the wildlife riparian habitat would be outweighed by the long-term opportunity for a much more robust riparian habitat with more native plants after revegetation. Most wildlife in the affected environment would benefit in the long run from a better riparian area.

3.16.7 Cultural Resources

Short-term uses of project area resources would not adversely impact the long-term productivity for cultural resources under any of the alternatives.

3.16.8 Recreation and Visual Resources

Alternative A would likely result in some loss of long-term productivity for both visual and recreational resources. Increased bank erosion and/or flooding damage to the channel and riparian area would decrease the aesthetic appeal of the project area. This, in turn, is likely to result in a long-term loss in recreational opportunity.

Short-term uses of project area resources would not adversely impact the long-term productivity for recreation and visual resources under any of the action alternatives.

3.16.9 Socioeconomics and Environmental Justice

Alternative A would likely result in some loss of long-term productivity for socioeconomic resources. The higher costs of flood insurance for residents within the existing 100-year floodplain, the increased potential for property damage from flooding, and the risk of decreased recreational and visual appeal for Coal Creek all combine to decrease potential long-term revenues while increasing the long-term cost of living for Cedar City residents.

Short-term uses of project area resources would not adversely impact the long-term productivity for cultural resources under any of the action alternatives.

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